Before the Day Breaks

by

Immanuel Velikovsky

FOREWORD

This unpublished manuscript is a chronicle of Immanuel Velikovsky's contacts and debates with Albert Einstein. The two men first met in the early 1920's, when Einstein edited the *Mathematica et Physica* section of *Scripta Universitatis atque Bibliothecae Hierosolymitanarum (Writings of the University and the Library of Jerusalem)*, of which Velikovsky was the general editor. There were a number of other contacts over the years, and in the late 1940's Einstein read parts of *Worlds in Collision* prior to publication.

Velikovsky begins his story in 1952, with a brief meeting at the lake in Princeton between the Velikovskys and Einstein. Velikovsky saw this meeting as a low point in the relationship between himself and Einstein. He then reviews, in a lengthy flashback, the contacts of the previous thirty years. Next he turns to the main subject of this book, the series of letters and conversations from 1952 to 1955 that were the setting of the ongoing debate between Einstein and Velikovsky on the subject of Velikovsky's theories, especially the role of electromagnetic factors in the celestial arena. By the end of Einstein's life, areas of disagreement between the two men remained, but those areas had been greatly reduced during the course of their increasingly cordial and productive discussions.

— Lynn E. Rose

INTRODUCTION

In the dark hours before morning, at the crossing of the Yabbok, flowing into the Jordan, Jacob struggled with a man whom he did not know; and the stranger, upon seeing the sky beginning to redden in the east, asked Jacob:

"Let me go, for the day breaketh." Jacob, however, replied:
"I will not let thee go, except thou bless me."

The title of this book is taken from this story in Genesis (32:24-27). The reader will find out at which juncture of our relations I exchanged this ancient dialogue with Albert Einstein.

For long months we carried on a struggle by written and spoken word; the subject of the struggle dealt with invisible but real forces, whether they do or do not take part in the movements of the silent mechanism that carries worlds on their paths. My claim of the participation of electromagnetic fields and their interrelations in the structure of the universe was opposed by him almost to the last, and this was *the* issue of the dispute. The Morning Star was also a subject of our contention.

The main story starts in August 1952, though there were some exchanges also earlier. We defined our positions, he in brief, I at length. Then, after an interruption of over a year, we came to closer grips. In letters (testimonials to the stands we took) in his marginal notes to manuscripts of mine, and in discussions that went sometimes nearly till midnight, we were not sparing of each other.

Before the debate started there certainly was in my opponent a preconceived stand which he shared with so many men of science who could not see in my published work any vrai- semblance of scientific truth. Yet as soon as the contact became personal it grew in warmth, and a reciprocal affection developed between us, unyielding as we were.

I believe it was not until our two long discussions accompanying the reading of my paper "On the Four Plans of the Universe" less than seven weeks before his death that my opponent fully comprehended my stand. By that time he had also read *Worlds in Collision* for another time, with a decidedly different reaction. At the end I felt as if he wished me to be proven right.

Our debate ended on Friday, April 8, 1955, only nine days before Einstein's death. I think I was the last person with whom he discussed a scientific problem. On that day I brought him the published news that Jupiter sends out radio noises; ten months earlier, in a letter to him, I had offered to stake our dispute on this my claim of an as yet undiscovered phenomenon — and at that time he let me have his reply in a marginal note to my letter. It happened repeatedly that he wrote his arguments in the form of notes, sometimes copious, on the margins of my letters, returning my originals to me; with notes he also supplied some of my manuscripts that he read: *Earth in Upheaval*, published half a year after his death, and *Stargazers and Gravediggers*, memoirs on the origin and reception of my work.

Over twenty years have passed since the figure that dominates this narrative left the abode of men. With the passing years many phenomena have come to light, and today it is sometimes difficult for a scientist to reconstruct his own and his colleagues' attitude of 1950 or 1955. And it is even more difficult for the young generation to envisage the stand of science in those years, almost a generation ago. Since then, many discoveries of the Space Age have completely changed our understanding of the structure of the solar system, and radioastronomy has brought home a new and exciting picture of cosmic spaces and of the forces that act in them. It is easy to be misled into thinking that this knowledge was already common in the early fifties; thus whom better to quote than Einstein as a spokesman for the prevalent scientific view of that time?

This short book is intended also as a personal tribute to a man who was simple to the extreme, strong in convictions, humble in fame, curious for human destiny, and very solitary.

If the years that have passed have not substantiated Einstein's stand in the arguments we exchanged, his very attitude in this exchange that much occupied his mind to the end of his life, and his effort to uphold the human dignity of a heretic ostracized by the entire scientific community, remains for me an unforgettable experience. I have tried to communicate to my readers this glow that lives in me undiminished since the dawn broke for me.

Many of the following pages were written when Einstein was still alive, and now, in a number of instances, I have had to change the present tense to the past tense. Other pages were written soon after his death, and some I add while preparing the story for print. Being now several years older than Einstein when he died, I think that I should not delay, but put together and leave a record of our relations and of the issue that divided us and bound us. I did not know intimately the man with whom I struggled before the dawn, but I sensed something angelic. *Before the Day Breaks* is a record and a tribute.

Princeton, 1976

At the Lake

It was August 1952, eight or ten weeks after we moved to Princeton. Elisheva and I sat on a bench at the boathouse on the shore of Carnegie Lake, which sprawls in the valley only a few minutes' walk from our home, and talked with the boatman. We saw a tiny boat with a sail approaching the anchorage. An elderly man with his head covered by a wide-brimmed hat against the rays of the setting sun came from the boat and, going toward the boathouse, looked at us with his friendly smile. Only now I recognized Einstein. I approached him and named myself.
"Ah, you are the man who brought the planets into disorder," said he in German, and the smile disappeared from his face. He was carrying the oars into the boathouse. I made a move to help him, but he kept the oars. I heard a challenge in this greeting and said:
"I would like an occasion to meet you and discuss. . . ."
"But what do you know of astronomy?" he said dryly.
"I know to put questions," I said, or only thought so.
"Not one of these days, sometime later," he said.
"May I write you?"
"Do it," he said, and was already a bit impatient to be away—his home is at the other end of town. His car moved on the unpaved road that runs along Carnegie Lake, and Elisheva and I went home, uphill, only several hundred feet from the mooring platform.

This short encounter made me realize that Einstein, too, was full of resentment against me. I had not yet had any chance to show him that I had thought through the physical consequences of the conclusions at which I arrived in my study of the natural phenomena of the past. Six years earlier, in 1946, as I will soon narrate, I had the ambitious plan to discuss with him the physical consequences of *Worlds in Collision*, then in manuscript, and on July 5th of that year visited him in his Princeton house. Einstein agreed then to look through a part of the manuscript. At that time he advised me to rework my book so as to make it acceptable to physicists and to save what was valuable in it; if I would not do this, I would not find physicists who would accept my views, nor a publisher willing to print them.

Since then six years had passed. Einstein was right: most astronomers declined even to deliberate my evidences; the publisher that had brought out my book had parted with me.

Now, after our accidental meeting, I wrote on August 26th a letter to Einstein:

> Dear Professor Einstein:
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> When, by chance, we met last week at the lake, I became aware that you are angry with me personally for my “Worlds in Collision.” From you I have not expected this reaction.
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> I have written a culture-historical book. A physicist cannot prescribe to an historian what he is allowed to find in the past, even if he finds contradiction between the alleged historical facts and our understanding of natural laws. There are facts a physicist observes daily which are in conflict with the laws he formulated; one such case is the keeping together of positive elements in the nucleus of an atom; he accepts the fact though it contradicts the law, and he looks for some explanation.
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> Two facts appeared to the scientists as fallacious in my book: 1. No forces in the celestial sphere but a head long collision could retard the earth in its rotation or incline its axis into a different astronomical position, and in such a collision our earth would have perished; 2. No planet could have come to its orbit as recently as a few thousand years ago, and therefore Venus could not have traveled on a cometary orbit in historical times.
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> These two assertions are true only if gravitation and inertia are responsible for planetary motions, a notion subscribed by every “vernunftigen Physiker.” Here, though no physicist or astronomer, I am provoked to disagree.
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> The sun has a general magnetic field, the solar spots are magnets, the solar prominences return on an oblique line to the place on the solar surface from where they erupted, the cometary tails are repelled by the sun in a manner and with velocities which the pressure of light cannot explain; the earth is a magnet; the ionosphere, the polar light, the ground currents, the terrestrial magnetism react to solar disturbances; cosmic rays are charges that travel in magnetic lines of force; meteorites come down in a magnetic state; the position of the moon influences the radio reception (Stetson); the position of the planets influences the radio reception (Nelson of RCA); the fixed stars are strong magnets (Babcock). In the face of all this is it true or wrong to insist that only gravitation and inertia act in the celestial sphere? And if

the electromagnetic fields are not invented by me for the solar system ad hoc in order to explain the phenomena and their interpretation as found in “Worlds in Collision,” then may I ask: Who is in conflict with observed facts, the astronomers that have all their calculations concerning the planetary motions perfect on the assumption that there are no electromagnetic fields in the solar system, or the author of “Worlds in Collision” ?

Venus could come to a circular orbit and the Earth could be retarded in its rotation or have its axis inclined, under the influence of electromagnetic fields. Such fields exist; at close distances they would act strongly. I believe, therefore, that not only the historical phenomena that I describe in my first book could have happened, but also that celestial mechanics that has all its motions explained without taking into account the electromagnetic fields in the solar system, is in conflict with facts.

I have read a book of a prominent astronomer of this city who says that nothing could take place in the celestial sphere which conflicts with the words of Jesus of Nazareth as preserved in the Gospels. Thus he has two world conceptions that live side by side in his mind—one of mathematics, the other of faith. But the rest of astronomers are like him: they acknowledge the magnetic and electrical properties of the sun and its spots, or of the fixed stars, of meteorites, of cosmic rays, occasionally also of cometary tails, and they do not deny that the Earth is a magnet, and that the sun, the moon, and the planets influence in some way the ionosphere; but as soon as it comes to the celestial motions, they still keep to pre-Faraday Laplace and Lagrange, and actually postulate sterile electricity and impotent magnetism, which do not act at distances, and which do no more than produce a Zeeman effect.

In my debate with Prof. J. Q. Stewart of Princeton Observatory in Harper’s Magazine, he presented the common view by asserting that electromagnetic forces have no part in the planetary relations. I, on the other hand, have written that the general solar magnetic field discovered by Hale (1912) was often denied to exist (Menzel). “Has not a basic mistake in observation or interpretation been committed?” Now this April, the same Menzel announces that the sun must have a very strong magnetic field, and that there was a difficulty of finding it because of the angle of observation.

For over two years I have been a target of abuse and calumny. When

did it happen that a spurious book caused such a fury in the minds of the contemporary scientists?

I have taken too much of your time. I wish you everything best.

Cordially,

Immanuel Velikovsky

To this my letter of August 26 Einstein answered the very next day. It reads in translation:[1]

A. Einstein
112 Mercer Street
Princeton
New Jersey, U.S.A.

27th August, 1952

Dear Dr. Velikovsky:

The reason for the energetic rejection of the opinions presented by you lies not in the *assumption* that in the motion of the heavenly bodies only gravitation and inertia are the determining factors. The reason for the rejection lies rather in the *fact* that on the basis of this assumption it was possible to calculate the temporal changes of star locations in the planetary system with an unimaginably great precision.

Against such precise knowledge, speculations of the kind as were advanced by you do not come into consideration by an expert. Therefore your book must appear to an expert as an attempt to mislead the public. I must admit that I myself had at first this impression, too. Only afterwards it became clear to me that intentional misleading was entirely foreign to you.

With friendly greetings,

Yours,

Albert Einstein

This answer, of words measured and precise, of a mathematical brevity, an art in which Einstein was a supreme master, made it clear that no argument in my letter produced any effect or even had attentive hearing, because I was up against a formidable structure erected by the greatest minds, proven correct by the supposedly most minute observations of the motions of celestial bodies; therefore it was not even a structure, but a natural massif, an Everest, that I was trying to shake. And who was I, and what was my knowledge, and against what opponents did I carry my arguments? Einstein was and still is considered the greatest mind, almost divine in his knowledge, whose word in the matters I was raising was thought infallible; and the great apparatus of mathematics was his, and the calculations of Newton, Lagrange, Laplace, Leverrier, and Newcomb were the basis for what he said, and the observations of the heavens for three centuries with ever greater telescopes unfailingly confirming the theory were on his side.

Yet, knowing me even as little as he did, how could Einstein think that my intention had been to mislead? In the two preceding years he must have been involved many times in discussions of *Worlds in Collision*, and the opinions of others must have colored his own. This would also explain his cold and even harsh greeting when we met at the lake. He was prepared to admit that I was deceiving myself; and deceiving myself I was, because I was pitting myself against the closed front of mathematics and astronomy.

In a hundred years, in over 400 revolutions, Mercury precesses (advances) ca. 5600 seconds of arc, of which 46 seconds are unexplained by classical celestial mechanics; the visible face of the moon is by comparison ca. 30 minutes, or 1800 seconds of arc. This anomaly of Mercury, so small, was so disturbing that for seventy years from 1845 when it was calculated by Leverrier, until 1915 when Einstein announced his General Theory of Relativity, it caused great unease among theoretical astronomers. Was possibly the mass of the sun unequally distributed?, it had been asked. Was possibly an undetected planet revolving between Mercury and the sun, obscured from observation by the sun's dazzling light? This was a problem which, so long as it remained unresolved, did not let astronomers live in peace; and only with Einstein's explanation for the phenomenon was the looked for solution found and peace restored: now, observations and calculations coincided almost precisely.

If such a tiny disagreement between observations and calculations made such an impression and claimed so many efforts for its solution, how could I brazenly claim admittance for two powerful natural forces, electricity and magnetism, into celestial mechanics? But I, on my part, thought it strange that nobody before or after Einstein had tried to figure out whether the Mercurial anomaly is or is not an effect of electrical or magnetic interrelations.

In the classical celestial mechanics there is no need nor place for electricity or

magnetism; but was it proper never to consider electricity or magnetism as the explanation of an anomaly in the celestial motions? Were these two fundamental forces completely taboo in celestial mechanics? In 1908 Hale at Mount Wilson Observatory found that solar spots are magnets several thousand gauss strong. And in 1913 Hale announced that he had detected a general magnetic field of the sun, which he computed to be fifty gauss strong at the solar poles. Was it methodologically correct in 1915, when Einstein wrote and published his General Theory of Relativity, to disregard Hale's publications, the magnetic nature of the spots, and the general magnetic field of the sun? Methodologically, it was an oversight, whether Einstein was correct in his solutions or not.

Einstein knew nothing, and could not know, of the scruples I had concerning what I considered a methodological oversight. If there are electromagnetic interrelations in the solar system, then of course they must be considered in their effects on the precession of Mercury, on the red shift, and on the bending of light—all three regarded as proofs of the General Theory of Relativity.

I sat down and wrote a long letter.

September 10, 1952

Dear Professor Einstein:

By your answer to my letter you have truly obliged me to think the problem all over again. I have tarried to answer because I did not wish to appear just obstinate; but the problem is permanently on my mind. I have to ask patience, which a "Fachman" is generally reluctant to accord to an outsider. Without this patience we shall build barriers between sciences, in this case—astro- nomy and history. I would certainly listen carefully to what you may say on history or psycho-analysis.

You say that the *fact* of the exact correspondence of the planetary motions with the theory proves this theory as correct: in the celestial motions only two agents participate—gravitation and inertia. Let us first assume that your statement of exact correspondence between theory and phenomena is rigidly correct. Still the mere fact of a force acting at an inverse square rate would not exclude electricity and magnetism, also acting at the inverse square rate, from participation in celestial motions. But the statement is not rigidly correct, either. Let me illustrate.

Here is the year 1845. Leverrier in France and Adams in England, out of perturbations of Uranus calculated, to the exactness of one degree of arc, the presence of a yet unseen planet. Both of them assumed that a planet of a size not larger than that of Uranus travels on an orbit at a distance dictated by Bode's law. Neptune is actually of the size of Uranus, but the mean distance between their orbits is not ca. 1,750,000,000 miles, as Bode's law required, but only ca. 1,000,000,000 miles; thus the error is equal to ascribing to Neptune a triple mass. The discovery of Pluto did not solve the conflict between the theory and the fact and caused also conflicting estimates of Pluto's mass. Thus the finding of the planetary stations in relation to a chart of fixed stars is not enough; if the theory is true the distances must also be correct. And still the discovery of Neptune is regarded as the strongest proof of the Newtonian theory of celestial motions.

Now in the same 1845, the year of this triumph, Leverrier calculated also the anomaly of Mercury, and by this caused to think that the Newtonian law of gravitation may be not precisely true. Leverrier first thought of some planet moving inside the Mercurial orbit or of a possible unequal distribution of the mass in the sun. You have used the fact of the anomaly to prove that the space is curving in the presence of a mass. About the same time—in 1913—G. E. Hale published his paper on "The general magnetic field of the sun" (Contr. M. Wilson Obs., #71), in which he estimated the general magnetic field of the sun as of 50 Gauss intensity. At this intensity "under certain conditions electromagnetic forces are much stronger than gravitation." (Alfven) The last named author in his "cosmical Electro-dynamics" (Oxford, 1950, p. 2) shows that a hydrogen atom at the distance of the earth from the sun and moving with the earth's orbital velocity, if ionized, is acted upon by the solar magnetic field ten thousand times stronger than by the solar gravitational field.

Now the visible streamers of the sun that conveyed to Hale the idea that the sun is a magnet reach a long way toward Mercury, almost half the way. Was the electromagnetic state of the sun ever considered as the cause of the anomaly? The effect of the e.-m. action must have been reckoned, and possibly excluded, but not disregarded. . . .

The *fact* that the theory accurately coincided with the observed planetary positions was the main argument for the Ptolemaic system and against the heliocentric system. For more than two generations, until 1600, it was not the Roman Church who opposed the Copernican theory; the scientists opposed it and used as their main argument their

> ability to predict planetary positions, conjunctions and eclipses. They have actually predicted eclipses that we still have to experience in the future. How could they achieve this degree of accuracy with the sun revolving on one of the orbs around the earth? By a continuous adjustment of their observations to their theories and their theories to observations. Similarly it is today. And when the facts prove to be different from what they were supposed to be—that the sun is charged, or that the cometary tails are electrically glowing, or that planetary positions of Saturn or Jupiter markedly influence our ionosphere,—then these facts are left outside of the theory and it covers less and less of the phenomena. No wonder that it agrees with the residual facts in such an arrangement.
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> Sometimes it seems to me that the hidden psychological cause of the emotional attitude of the scientists to "Worlds in Collision" is in its reminding a few repressed physical facts. In that book I have not invented new physical laws or new cosmical forces, as cranks usually do; I have also not contradicted any physical law; I came into conflict with a mechanistic theory that completely coincides with a *selected* group of observations; my book is as strange as the fact that the Earth is a magnet, the cause of which is indeterminate and the consequences of which are not estimated in the Earth-Moon relations.
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> When over a year ago, Professor Stewart, your neighbor, was invited together with myself by the Presbyterian Society of this town to participate in a debate about my book, and the time became short, I asked my opponent: "But you have excluded the existing electromagnetic conditions in the solar system from the celestial mechanics," his answer was: "We do not need them: our calculations are perfect without them." Later, when our debate was renewed on the pages of Harper's Magazine, I observed: "If the balance sheet of a bank is correct to the last cent, but two large deposits (electricity and magnetism) are omitted, the entire balance may be questioned." . . .

I did not really expect an answer from Einstein, nor a conversion on his part. I did not speak basing my arguments on my work on global catastrophes; nor did I draw my evidence from folklore; I was enumerating physical facts left outside the domain of celestial mechanics, though they, by right, belonged there. A minute discrepancy in the motion of Mercury was noticed; to its explanation the majestic structure of the General Theory of Relativity was erected. Larger discrepancies, however, were left out of the discussion, or, in other cases, quite unsatisfactory explanations were offered, like light pressure as the cause of the behavior of cometary tails: no quantitative analysis was made for this assumption, yet it was taken into the

textbooks.

To my letter of September 10 there was no answer, and the finality of Einstein's previous short letter did not engender a hope for give and take. In that letter between my two, Einstein spoke of my evidence as if it consisted mostly of folklore—but it was physical. I wrote in my notebook:

> As to the first paragraph of his letter, I was genuinely satisfied to have it in this wording. Not only the general public, but even people who know something of the natural sciences imagine that Einstein introduced electromagnetism into celestial mechanics. What he is actually trying to do is to find a unified theory in which gravitation should be integrated in a common structure with electricity and magnetism, as light was brought into the electromagnetic field theory by Maxwell, and before this, electricity and magnetism were found to be interrelated by Oersted in 1820. In his letter Einstein made it clear that he, like all others, regarded gravitation and inertia as the only forces that act among the celestial bodies and keep them on their orbits.

I thought: This is the second best reply I could have had—at least the opposition was spelled out; an agreement with my argument I could hardly expect.

As to his second paragraph—I saw that the muddy wave of suspicion had reached even Einstein and infected him for a while, despite the fact that he knew me a little from former years.

I have repeatedly, and also very recently, been asked: "What made you so strong that you could persevere in the face of a concerted opposition of the entire scientific establishment, and to do it for so many years?" Whether this is the true ground or not, I usually answered, "It is the obstinacy of my race, the race of Marx, of Freud, and of Einstein."

References

1. See Appendix I for the original text in German.

A Flashback

Thirty-one years earlier, on a late summer afternoon in 1921, I was the only stranded passenger in a small station on the frontier of Lithuania and Germany. I followed with my eyes the train that carried my parents; it left the platform and soon disappeared from sight. It was the end of our three years of wandering in Russia, in the Ukraine and the Caucasus, lands torn by civil war; perils of death were more than once only an arm's length away as we sought to reach the land of Israel, the elusive goal of our striving. Now, finally, my parents were traveling toward the West, intending to continue from there to the land of Israel.

Waiting for a train that would take me back to Kovno (Kaunas), I found a rack with books at the newsstand. I purchased a small book on Einstein's theory. This was very possibly the first time I encountered the name. I had only recently emerged from what later became known as the Iron Curtain—from the vast plain of a great country racked by war, disorganized and famished. Latvia and Lituania, where I now found myself, were independent republics. Hardly any news about scientific progress in the outside world reached the reading public in the Soviet Union in those years. However, it is possible that during the several weeks that I spent in Lithuania the name of Einstein could have already met my eyes from a page of a Kaunas newspaper. I had not yet heard of Minkowski; the name Lobachevsky was familiar to me. There in the station building, and then on the train on the way back to Kaunas, I read the purchased paperback, and I was electrified. The theories presented in it stirred in me an intense interest, and even emotion. Energy is a form of matter; time is a fourth coordinate—in that first description of Einstein's theory that I read, ideas that had already visited me seemed to abound. I was rarely so struck by what I read as I was then.

Several weeks after parting with my parents at the train station in Lithuania, I came to Berlin by way of Stockholm to meet them again. I believe it was that very evening that my father told me that out of what was left him from all his possessions he would donate a large portion for a humanitarian purpose. Such were his ways all his life; he wished with the little means that he still had available to him to initiate something of great design—he thought of propaganda for peace. But I had a different idea, and my father agreed with me. My idea of organizing a series of scientific publications to serve as a platform for Jewish scholars around the world in preparation for the establishment of a Hebrew University in Jerusalem immediately appealed to him, and he offered me generously from his shrunken means to fund the *Scripta*.[1]

I met Prof. Heinrich Loewe, a librarian of Berlin University, and found in him an enthusiastic collaborator. We approached a number of eminent scholars of Jewish origin. The Jew was known the world over as a tradesman, but the renown of the nation's scholars belonged to other peoples. Rothschild was a Jew—everyone knew this. But many of the great names of science—Hertz, Michelson, Ehrlich, Wasserman, Minkovski, Bohr and others—belonged to the halls of fame of other nations.

Professor Loewe approached Einstein, and he agreed to be the editor of the part *Mathematica et Physica.* During the process of editing the papers in the section on *Mathematics and Physics,* I repeatedly met Einstein in his apartment in Berlin. He was then at the zenith of his fame, having been awarded the Nobel prize for physics in the previous year at the age of forty-one. His face was young, and framed by dark hair. I did not pretend to know much about the subjects discussed in the articles, and Einstein himself admitted to not being acquainted with several of the fields discussed by other authors. We had some interesting conversations. Still unconvinced that the Jewish nation needed to be preserved and not assimilated, he once remarked: "Are not all races equally ancient?" I called him to the window, next to which he had a small telescope, and asked him to look down on the street, and told him: "Do you see those cobblestones of which the road is made? They are ancient, but they are not collected and preserved in a museum."

He was always friendly, as was also his wife, who was his cousin; it was she who regularly opened the door, and both of them would be at the door, friendly, when I would leave.

The work on *Scripta* progressed, and the eminence of the Jewish people in science and the humanities started to shine through. Some barriers had to be overcome, since the original works were to be printed not only in the language of their authors, but also in Hebrew translation. It fell to my task to create something like a collegium of translators, for at that time schools of higher learning did not exist in Hebrew, except Yeshivot. In many cases new terminology needed to be created. This work was partly helped by *Sfotenu,* two volumes of Hebrew terminology, published in Russia in former years with the funds of my father under the editorship of Dr. Joseph Klausner.

For two years I worked passionately on this undertaking. By the fall of 1923 over thirty bilingual monographs were printed. Most of them were subsequently united in two volumes, *Mathematica et Physica,* and *Orientalia et Judaica.*

In 1924 the British journal *Nature,* reviewing the volume on "Mathematics and Physics," observed that if from a population of thirteen million Jewish people sprang

talents like Edmund Landau, Karman, Hadamard, Einstein, Levi-Civita, Loria, Born, Landau and others, then clearly the Jewish nation was unusually rich in creative spirit and ability. The published volumes served the National Library in Jerusalem (later University Library of Jerusalem) for exchange with many scientific institutions for their publications.

I lived a number of years in what was then the British mandated territory of Palestine, working as a medical doctor. In 1928, after the death of my mother, I turned my interest to psychoanalysis. In the spring of 1930 I wrote on "The Physical Existence of the World of Thought," to which Eugen Bleuler, the dean of world psychiatry, whom I came to know, wrote a preface, stressing the pioneering nature of my work and revealing that he had harbored very similar ideas.

In 1939 I came with my family for a sabbatical to the United States to complete research on a manuscript on Freud and his heroes. A few weeks later the World War started, and humankind was enveloped by catastrophe for the second time in the space of twenty five years.

In 1940 I approached Einstein and discussed with him a plan for the foundation of an Academy of Sciences in Jerusalem—before this I had started a series of scientific papers called *Scripta Academica* with a paper by Chaim Weizmann and E. Bergmann. Einstein added his signature to the list of those who agreed to participate—it was headed by Franz Boas and Enrico Fermi.

Soon afterwards my research led me to an understanding that at the time of the Exodus an enormous natural catastrophe took place—an understanding that brought me to a realization that the ancient history of the Near East needs synchronization, and natural history needs a reconstruction. I spent the next several years in libraries reading and writing. Two manuscripts, *Worlds in Collision* and *Ages in Chaos*, resulted from these years of labor.

After a period of six years, during which Einstein and I had not met, I went to Princeton to see him on July 5, 1946. His telephone was not listed, and the telephone office did not supply the information without checking with the scientist about whether he wished a particular party to be given his telephone number. He asked me to come on that day, and I took my daughter Shulamit with me. She had spent many mornings with me in discussing some aspects of the gravitational theory. At that time she was taking graduate courses at Columbia University, having received her honors degree in physics from Hunter College in New York. She was my silent companion.

I never thought I would ever discuss physical problems with Einstein. But, as explained above, my work on natural upheavals of the past led me to consequences

which I could not disregard. Going now to see Einstein, I knew I would not be able to explain all that I had thought through about the role of electrical and magnetic forces in the solar system, although I had it in writing. He received us on the terrace at the back of his house, overlooking the yard with tall trees; he was wearing sandals, and greeted us with his unique kindness and smile. Two hours passed in a discussion, my daughter listening. I did not feel like saying—"I have found some of the premises of the astronomers to be wrong" ; my intent was to prepare him through the reading of my manuscript to wonder about the conflict that presents itself between the theory of changeless orbits and the conclusions that ask to be drawn from the material I had assembled. I left with him the first half of my manuscript of *Worlds in Collision,* the part dealing with Venus. Three days later he already wrote his answer:[2]

July 8, 1946

Dr. Immanuel Velikovsky

526 West 113 Str.
New York City

Dear Mr. Velikovsky:

I have read the whole book about the planet Venus. There is much of interest in the book which proves that in fact catastrophes have taken place which must be attributed to extraterrestrial causes. However it is evident to every sensible physicist that these catastrophes can have nothing to do with the planet Venus and that also the direction of the inclination of the terrestrial axis towards the ecliptic could not have undergone a considerable change without the total destruction of the entire earth's crust. Your arguments in this regard are so weak as opposed to the mechanical-astronomical ones, that no expert will be able to take them seriously. It were best in my opinion if you would in this way revise your books, which contain truly valuable material. If you cannot decide on this, then what is valuable in your deliberations will become ineffective, and it may be difficult finding a sensible publisher who would take the risk of such a heavy fiasco upon himself.

I tell you this in writing and return to you your manuscript, since I will not be free on the considered days.

With friendly greetings, also to your daughter,

Your

Albert Einstein

The letter contained one positive statement and two negative ones, expressed with vigor and finality not given to appeal or reconsideration. To have Einstein subscribe to the thesis of global catastrophes in historical times and, furthermore, to make him agree with the extraterrestrial origin of such events can be counted as an achievement: this acceptance immediately carried Einstein into the camp of the catastrophists—not even a camp, because hardly anyone in the mid-twentieth century believed in the notion of global catastrophes. Astronomers had not produced a single man from among their ranks who would have conceded as much as Einstein did in that letter.

But I found no satisfaction in the concession obtained at the beginning of the letter because I hoped for more. I hoped that I would be able to continue the discussion started on July 5th and to lead it to the subject that was the purpose of that discussion, namely, the consequences for celestial mechanics that followed from the historical events presented in my work. My stand was later formulated in the Preface to *Worlds in Collision:* "If, occasionally, historical evidence does not square with formulated laws, it should be remembered that a law is but a deduction from experience and experiment, and therefore laws must conform with historical facts, not facts with laws." I had planned to spread before Einstein the many facts that all point to the unjustified omittance of two all-pervading and interdependent natural forces, electricity and magnetism, from all and every consideration of being active agents in the plan of the universe, and in the mechanics of the solar system.

Now the discussion was cut short before we reached the theme; Einstein called off our next meeting and there was no point in asking him to read the second part of the manuscript. It appeared also that he was under the impression that he had seen the entire manuscript, whereas it was but the first folder that I had left with him.

Had I been insecure in my work and its conclusions, this would have been the moment to reappraise the entire endeavor. But I was so completely convinced of my theses that my reaction was not of re-orientation in order to salvage what to Einstein appeared as valuable in my manuscript and thus to secure a good chance of publishing it. It was a short-lived regret that my effort with Einstein was luckless. I wrote to him on July 16, 1946:

> Dear Professor Einstein:
>
> I thought carefully of what you wrote in your letter of July 8, for which I thank you very much. I thank you also wholeheartedly for the time you gave me on July 5, and for reading a part of my Ms "Worlds in

> Collision."
>
> I was perfectly aware that my historical cosmology is in conflict with the accepted physical laws, and because of that I asked you to read it. You stress two instances. The reversal of rotation (not revolution) is attested not only in traditions but also in geo-physics: the magnetization of rocks "indicate that the polarity of the Earth has been completely reversed within recent geological times." . . .
>
> In the last part of my cosmology I try to solve the problem of the conflicting geological and historical data versus the accepted laws.
>
> Best regards to Miss H. Dukas who received us with friendliness at your home.
>
> Very truly yours,
>
> Immanuel Velikovsky

My efforts, accordingly, were directed to the following tasks:

First, to have one of the conclusions of my work, identifying Venus as the agent which caused the great global catastrophe, checked by a physical method, namely by spectroscopy on the presence of hydrocarbons, and already before approaching Einstein I had approached the Harvard College Observatory with the request of having this specific test made. The description of that step and the correspondence that ensued during April and May find their place in a separate publication.[3]

Second, to have my work's implications for celestial mechanics presented to a limited circle of specialists in a concise form, with physical facts being the only material of discussion. In this way I would be able to hear criticism of these implications in and of themselves, apart from the historical-mythological material which inspired them.

Thirdly, I decided not to postpone any longer and to inquire into the possibility of presenting my manuscript in book form to the scholarly world.

References

1. The full title is *Scripta Universitatis atque Bibliothecae Hierosolymitanarum (Writings of the University and the Library of Jerusalem).*
2. See Appendix I for the original German text.

3. *Stargazers and Gravediggers*, (William Morrow Co.: New York, 1983).

Before the Forum

Having surveyed the years when we created the *Scripta* and, again, the years of occasional contacts in the United States, first on behalf of the plan to initiate the Academy, then on behalf of my own work, starting with the visit of early July, 1946 in Princeton, I return to that period when, upon having met Einstein at the lake and exchanged letters with him, the contact seemed to be torn again. Yet, apparently, my bearing intrigued him. One evening, later in the fall (1952) I received a visit from a chemist, Dr. Plungian, accompanied by his wife, Gina, a sculptor. Gina was a friend of Einstein's daughter, Margot, who was also a sculptor. The Plungians had heard from Einstein that I was living in Princeton. Gina, interested in what she had read about my work or was told by Einstein, and generally interested in writers and artists, was pleasantly surprised to find that my wife also was a sculptor. Dr. Plungian came to invite me to deliver a lecture before the Society for the Advancement of Science of Summit, New Jersey. This is the site of Bell Laboratories, one of the largest scientific laboratories in the world; the members of the Science Society there were for the most part scientists working for Bell. I accepted the invitation.

I addressed a large audience at Summit. The lecture took place in February 1953. The chairman of the Society, Dr. Joseph Baker, met me in the hall and before I entered the large auditorium worriedly inquired whether I would be able to restrain myself if some in the audience should become abusive. I assured him that he had nothing to worry about.

In my lecture I spoke mainly on the geological problems that are related to the theory of *Worlds in Collision.* The question period went off without a disturbance. At tea in the gallery the discussion went on for another hour and I realized the great appeal that geological problems— of sea depths, of mountain building, and of ice ages— have to the minds of many. As I took leave of him, the chairman announced: "Dr. Velikovsky has acquired a new follower in me."

On another occasion I was asked to meet a group of scholars and scientists at the home of the Plungians; Dr. Shockley, the co-discoverer of the transistor, and a future Nobel Prize winner, led the discussion. We had a little mathematical skirmish in which I happened to be right, and he generously and immediately admitted it.

About that time Margot Einstein, who had known Elisheva since the 1940's , began to come to our home. Margot and Elisheva met in 1941 at Columbia University,

where they both studied sculpture under Oronzo Maldarelli. Once Margot arranged for Elisheva to come to Princeton to play quartets with Einstein. Elisheva is a professional violinist, and used to give many concerts before we came to the United States. And so in April 1944 Elisheva came to Princeton, arranging for a violist and a cellist to join her, and played with Einstein three string quartets of Mozart.

At one of her visits Margot told us in great detail of her experience in Holland during the Hitler regime, and mostly her stories were about animals— lambs and birds— with whom she related better than with human beings in this evil world; it seemed she wished to be well thought of by us. Occasionally she came with Miss Helen Dukas, Einstein's secretary. Miss Dukas had then been with Einstein for almost twenty-five years— she entered her service with him several years after I knew him in Berlin. After the death of his second wife, she took care of his correspondence and of his household. Elisheva and her musical colleagues would have chamber music at our home, and a small company of intellectuals would gather at these occasions; there were animated discussions. Miss Dukas and Margot were present a few times and enjoyed these evenings.

The Graduate College, or Proctor Hall, lies separate from the Princeton University Campus; its tower is seen from a distance, rising above the fields and golf courses, by any car traveling on U.S. Route 1, and is the first visible landmark identifying the university town, hidden in verdure. The Common Room, with its ornately panelled walls, and leather easy-chairs, is reached through a gateway and a quadrangle.

In the fall of 1953 I was invited by the graduate students of Princeton University to address their Forum; the student who invited me, as I recently found out, was George Field, ten years later a scientist of achievement and subsequently Director of Harvard College Observatory, a post once occupied by Harlow Shapley. I was glad to have this occasion. As the theme of the lecture I selected: "*Worlds in Collision* in the light of recent findings in Astronomy, Geology and Archaeology."

The lecture took place on the evening of October 14. The Common Room was filled and many stood around the walls and in the doorways. In the front row sat Graduate College Dean Sir H. Taylor and other dignitaries. Among those who remained standing for about two hours— for the address and discussion— were, as I hardly noticed, Margot Einstein, Helen Dukas, and Gina Plungian.

Before the lecture started my wife overheard one of those in the audience, a graduate student or an instructor, as he assured his neighbor that it would be fun to listen to a crackpot. But as soon as I began, the audience followed my delivery with great attention. I offered non-conformist views, but there was nothing in them to confirm the expectation of a circus performance. I spoke for over an hour. A question and

answer period followed. A few days later a young friend, a twenty-four year old assistant professor of aerodynamics, Ronald Probstein, told me how a scholar in the audience with a pipe in his mouth looked on with sarcastic triumph when the question period started, and changed his expression with every answer I gave.

Question and answer periods, then and since then, have been my forte; the audience apparently discounts the knowledge that a lecturer offers in his delivery, since it could be carefully prepared, but is surprised to observe that a lecturer has the information needed to answer and rebut questions from the floor. I answered without difficulty the queries of all who came up from whatever department. There was one inimical graduate student in geology who loudly inquired: “Whom did you read on Rancho La Brea?” And he suggested that this deposit contradicts my assertions. I answered: “In my lecture I have not discussed Rancho La Brea; but I read Merriam’s monograph.” “I worked with Merriam’s son,” said the student. Merriam was the original investigator of that deposit at a time when it was on the outskirts of Los Angeles— now it faces the “Miracle Mile,” the elegant shopping avenue. Actually the asphalt beds of La Brea offer great difficulties for the uniformitarian theory of evolution: human bones were found under a skeleton of an extinct vulture; a multitude of bones, smashed and broken, were found there, not in good order or shape— despite what the student had asserted in his question. Yet, the student announced: “Catastrophes are your brainchildren,” and thus had the last word. I did not answer. The audience applauded me warmly, and the student approached me to offer his apologies for his rudeness.

In the course of the lecture I made two statements as to the future findings I expected; after having reported on the manifold confirmations that had accumulated in the three and a half years since the publication of *Worlds in Collision* I thought it proper to conclude with one or two new predictions. For some time I had in my notes suggestions for tests to be made. I put it this way:

> In Jupiter and its moons we have a system not unlike the solar family. The planet is cold, yet its gases are in motion. It appears probable to me that it sends out radio noises as do the sun and the stars. I suggest that this be investigated.
>
> It is generally thought that the magnetic field of the earth does not reach sensitively to the moon. But there is a way to find out whether it does or does not. The moon makes daily rocking movements— librations of latitude, some of which are explained by no theory. I suggest investigating whether these unaccounted librations are synchronized with the daily revolutions of the magnetic poles of the earth around its geographical poles.

Actually, both tests suggested were derived from one and the same concept: that the celestial sphere is not electrically and magnetically sterile.

After the lecture one of the graduate students who surrounded me told me about certain folkloristic material of the Indians that would support my views; I observed that he did not come forward to say this during the question period.

As I walked to my car, I chanced to meet in the dark the three ladies who had come from Einstein's house to my lecture: his daughter, Margot, his secretary, Helen Dukas, and their friend, Gina Plungian. Later Gina told me that when she had called to take Margot to the lecture and Miss Dukas joined them, Einstein said that he was eager to go, too, but was conscious of the interest that would be centered on himself to the detriment of the proceedings. He added, however, that he expected to receive three reports from the three ladies. And he did. Gina Plungian later said that the dinner hour at Einstein's the day after the Forum was spent discussing my lecture, and Einstein expressed sympathy for my position, that of a lone thinker defending his ideas.

The Princetonian, the undergraduate students' paper at Princeton, printed two articles about the lecture. In the first it described how "with sheaves of documented evidence, Velikovsky quoted a myriad of scientists in these fields whose recent work, he said, made his theory more conclusive." In the second article it said: "After his lecture last night, he impressed all attending by his well-reasoned and well-documented answers to questions posed by experts in physics, geology and other sciences."

In the next few weeks I put the lecture into writing, following the notes I had before me when addressing the Forum. After it was typed I gave a copy to Lloyd Motz, astronomer at Columbia University. Since the beginning of 1950 I had met with him on a number of occasions in his room on the upper floor of the Michael Pupin Physics Building. The subject we discussed was always the same: my insistence that the solar system, and by implication, the universe, is not electrically and magnetically sterile.

Since those memorable days at the end of 1949 and beginning of 1950, I would, at intervals of five or six months, again and again return to Motz, trying to prove to him by enumerating a series of physical facts, some of them discovered since our previous meeting, that the accepted celestial mechanics could not be right in excluding electricity and magnetism from participation in the movement of the celestial "clock." The arguments must have been much the same as those that I used in my letters to Einstein in August and September of 1952. Motz would patiently listen and remain adamant. I would describe the motion of the cometary tails and insist that the accepted explanation of this phenomenon as being due to the pressure of light was inadequate. I was trying to evince from Professor Motz the concession that this was a

decidedly insufficient explanation that could not account for the observation of a large comet sweeping with its tail hundreds of millions of miles of space in a matter of a few hours, when going around the sun at perihelion. Yet, he would still try to explain it by the pressure of light. The sentence concerning the radio noises of Jupiter startled him, and we discussed it.

I asked for a meeting with Professor V. Bargmann, a physicist who was possibly closest to Einstein of all the scientists in Princeton. I remember the evening I visited him in his room in Fine Hall on the campus. I discussed the question of electromagnetism in the solar system. Instead of slowly preparing the issue in his mind, I showered him with facts and details that indicated the inadequacy of purely mechanical explanations. I assume that he must have been left with the impression that I was a man stubbornly questioning fundamentals which were beyond questioning. However, had he been present at my lecture in the Gradate College, he would not think me without some knowledge, or with a deficiency in logic. At that my first meeting with him, Bargmann was a patient listener, possibly believing me to be irrepairably lost to a fallacious view of things celestial, or perhaps recognizing some sound argument in what I said.

I left with him the typed text of my address before the Forum with its claims of radio noises coming from Jupiter and a magnetosphere surrounding the Earth and reaching the Moon. Though he intended to return it to me after he had read it, it so happened that he misplaced it and only found it over three years later— all of which was fortunate, and thinking of such incidents I could not help feeling that Providence was taking part in these matters: for in the meantime, in the spring of 1955, radio noises from Jupiter were discovered, as I had predicted in my lecture of 1953.

At McCarter Theater

A couple of weeks after my lecture before the Forum, it happened that at a concert at McCarter Theater in Princeton we met Einstein. It may be that he made up his mind to show a little of his change of heart in order to erase the impression of rejection he had left with me over a year earlier. During the intermission he stood up, greeted us from his seat a short distance away, and asked me to sit and chat with him. I took a temporarily vacant seat in the row in front of him, turning my head to hear him speak. There was something very unusual in this man. I am not a hero-worshipper, more nearly an iconoclast: great names do not startle me, nor do they make me feel humble. But in Einstein I felt this time something I had not felt on meeting him in Berlin, when he was a jolly man in his early forties who had achieved singular and spectacular success which was still new to him, and I was still in my twenties; nor when I spent time with him again in New York in the spring of 1940, nor when I visited him in the summer of 1946.

In 1921 he was a young-looking man with well-filled cheeks, warm and sparkling eyes, a forehead framed by dark and wavy hair, and a moustache over soft lips, with a ready laugh—almost the likeness of a bon-vivant. Epstein, who portrayed him several years later as flimsy, furrowed, and wiry, did not succeed at all. Now, thirty years later, at the age of seventy-four, the change in his appearance was very great. He had grown old, yet stood erect, with his grey-white hair, now long, falling on his collar. He had a kind face, and a clear and sonorous voice. Sufferings and private losses and human destiny had cleansed him and spiritualized him. He looked at me with kindness, and warmly pressed my hand with his own fleshy hand. The mattness of his face lighted up.

I reminded him of the *Scripta* on which we had worked together in Berlin. This made him wonder aloud on the mystery of time. Is time a stream flowing always in one direction from the present to the past? Do the present, future and the past all exist simultaneously? He wondered and asked me. Yet he brought counterargument to his own thought: but we cannot remember things that are in the future. This did not appear to me a valid argument, but I did not say so. Instead, I referred to Plato’s discourse on simultaneous existence of the past and the future. The field of parapsychology deals with such problems. Yes, once I wrote and published something on the subject, and Freud commented in a letter. Einstein asked me whether I still had Freud’s letters, and whether he could read one. I promised to select a letter for him to read. And we continued so, already old friends, when the bell

called the audience into the hall. I returned to my seat.

I sent Einstein the letter of Freud that he wished to see. In that particular letter Freud wrote me, as usual by longhand, that he had similar, almost identical ideas, and that he would subscribe to the preface to my work written by Eugen Bleuler.

A single week passed. There was again a concert at McCarter Theater: Einstein hardly showed himself twice a year in public, but this time he came again. Again, during the intermission—he sat across the aisle—he asked me to take the vacant seat next to him. Some of the Princeton graduate students sat in the row in front of my wife, and she could hear them wondering at this fellowship: Einstein when in public was of course the center of attention, though the public tried to make this not too obvious. Einstein spoke of religion, and mentioned Spinoza, a spirit toward whom he probably felt affinity. Like himself, Spinoza was a lonely man; like himself he was not concerned with material goods; like himself he was in conflict with men, though he was kind and humane; and like himself he was deeply religious, though not in the church or synagogue, and it is no wonder, if one considers the great sufferings to which his mentor Uriel Acosta was subjected—one of the saddest chapters in the long story of the Jewish people. But Spinoza was an Aristotelian, without wishing to be so; the cold reason which insists on explaining away anything unusual or singular separated Aristotle from his teacher Plato, who tended to the esoteric, the wonderful, and the singular.

Not long thereafter my wife and I received an invitation to have tea with Einstein. The day before our visit I found in the mail a letter in which the writer, a resident of Seaford in England, wrote:

> The “authorities” will object to your subversion of their life-work, but it is from their minor followers that the bitterest opposition will come. Those who exercise authority are not so shocked by rebellion as their underlings. They are doubly offended, for you threaten their security and insult their judgement. . . . The one Roman Catholic I would expect to sympathize with my doubts on infallibility would be His Holiness. It is the hedge-priest and Sunday School teacher who would cry “Blasphemy!”

112 Mercer Street

Einstein's house at 112 Mercer Street is located only a short distance from Nassau Street, the main street of this university town. Nassau Street at its western end divides into several avenues, like the trunk of a maple tree that throws many unequal branches simultaneously at one and the same joint. Two of the streets run toward Trenton; if one should walk along one of them, Mercer Street, past the buildings of the Princeton Theological Seminary, he would find Einstein's house on the left side where the street begins to go downhill. The wooden two-story building stands between not dissimilar neighboring structures. It is unpretentious with a narrow front and stretches into the backyard with its gray-painted sidings. Located in an area of low elevation, it is probably in one of the less comfortable parts of town, hot and humid in the summer. Einstein used to leave the town in the summer months and go to Saranac Lake in the Adirondacks, but in later years he discontinued his summer departures and stayed home.

Continuing a block or two along the street, one comes to Springfield Street on the left, and this well-shadowed valley would bring Einstein on foot to the Institute for Advanced Study—he had only to choose one of the streets with mansions or well-kept villas, like Battle Road, to turn right and then he could already see the Institute, built in the nineteenth-century style, in red brick, with a cupola and spire, standing out across a field from the approaching visitor. In later years Einstein discontinued his daily walk to the Institute and back and used the Institute vehicle, a kind of small omnibus, which would pick him up as it did other members.

In the Institute he was rather lonely. I once read that Gödel, who used to travel on the same bus, was closest to him of all the members of the Institute. Dr. Kurt Gödel, a mathematician and a great introvert, who lived at the other end of the town, was a silent man, with greying hair, who even in summer bundled himself against drafts, and was certainly of limited inspiration for Einstein who, though solitary, was greatly interested in human contact, warm in handshake, roaring with laughter. Gödel, like other famous mathematicians in the history of this abstract and exact science, produced the feat that made him famous at an early age, in his twenties, only to find the spring dry in the following decades. They could converse on some philosophical subject—I repeatedly saw Gödel on the third floor of the University Library studying books on philosophy or psychology.

A man of very different disposition and much closer to Einstein was V. Bargmann, a

theoretical physicist, who was not a member of the Institute, but a professor at Princeton University. He was—and is—an unswerving follower of Einstein, prepared to offer a fierce front to anybody who would challenge Einstein's theories. I believe that among the physicists in Princeton Bargmann was closest to Einstein while the younger generation of physicists showed a certain skepticism concerning the General Theory of Relativity in view of its apparent conflict with Quantum Theory, and because of Einstein's rejection of Heisenberg's Principle of Indeterminacy ("God does not play dice").

Before the Chair of Jupiter

On November 8, Elisheva and I went to Einstein and were seated in the living room. When one enters his house, proceeding through the narrow hall, the living room is to the left; directly ahead is a steep staircase leading to the second floor: on the second floor there is a room with a large window toward the backyard, with a low table, books, chairs, and next to it to the right another room, also lined with books. In a little while Einstein came from the upper floor to us, his long hair well-groomed, his face lighted up with his friendly smile. He started to move a chair with a straight high upholstered back, which had already drawn my attention in the modestly furnished room, and as I helped him, a help he graciously accepted, he said, “this is my Jupiter chair.” During our conversation I took this lead and remarked that if one evening I should stop every passing student and professor on the campus and should ask which of the stars was Jupiter, it is possible that not even one would be able to point to the planet. How is it, then, that Jupiter was the highest deity in Rome, and likewise Zeus in Greece, Marduk in Babylonia, Amon in Egypt, and Mazda in Persia? All of them represented the planet Jupiter. I asked Einstein if he knew why this planet was worshipped by the peoples of antiquity and its name was in the mouth of everyone? Its movement is not spectacular; once in twelve years it circles the sky. It is a brilliant planet, but it does not dominate the heavens. Apollo, the sun—the dispenser of light and warmth—was only a secondary deity. After inquiring and hearing from me again that Marduk was the Babylonian name of the planet Jupiter and Mazda its Persian name, he expressed his wonder. Then I told him that in the *Iliad* it is said that Zeus can pull all the other planetary gods together, the Earth included, with his chain, being stronger than all of them together; and that an old commentary (by Eustatius, a Byzantine scholar) states that this means that the planet Jupiter is stronger in its pull than all the other planets combined, the Earth included. Einstein admitted that it was really very strange that the ancients should have known this.

When, after three quarters of an hour, during which we were served tea, we rose to go, Einstein kept us, saying, “We have only started.” In order not to appear a bore, or a fanatic of one idea, I repeatedly changed the theme of conversation, as was so easy with Eistein, whose associations were rich and whose interests were many; the conversation was vivid. We spoke again of the problem of time, which apparently occupied his mind then, and of coincidence and accident. He observed that it was an accident of unusual rarity that his chair should occupy its very position in space, but that it was no accident that we two were sitting together, because *meshugoim* are attracted to one another—and he laughed heartily and loudly. *Meshuga* is a Hebrew

word, and it means “the possessed” ; in the Jewish-German parlance it is often heard, and it means “crazy,” in both senses (like the English word), more often in its milder meaning. Thus he likened me to himself. On this occasion, and several times more at other occasions, he liked to stress that each one of us is entirely alone in his scientific standing. This was also said to heighten my spirit—was he not lonely, too? Of course, there was an enormous difference in our positions in the scientific community and in the attitude of the scientific world toward us—beyond comparison. I took up the problem of coincidences to illustrate it by several examples.

The authors of the Declaration of Independence were Adams and Jefferson, who subsequently became the second and the third presidents of the United States. They both died on the same day, and it was the fiftieth anniversary of the Declaration of Independence. What is the statistical chance of this coincidence of three dates? Or if a schoolboy or a man in the street should be asked to select the greatest statesman of the nineteenth century, and the greatest scientist of that century, he would most probably select Abraham Lincoln and Charles Darwin: both were born on the same day, February 12, 1809. Or similarly the two greatest writers of their age, Miguel Cervantes and William Shakespeare, died on the same day, April 23, 1616.

I mentioned these instances to illustrate the idea that coincidence sometimes bears the mark of the miraculous, and sometimes the explaining away of telepathy is stranger than telepathy itself, for which I offered a naturalistic explanation in my paper on “The Physical Existence of the World of Thought.”

Before we left, Einstein told us of his dream of the night before. This dream impressed him strongly and he recounted it it with a voice of unusual warmth and passion, expecting that I would interpret it. He also related a dream he had had many years ago about an old colleague whom he had not liked, and he told the story in detail. The old dream’s explanation he already knew. I felt regret in having to disappoint him, but in accordance with standard psychoanalytic procedure I offered no clues to the understanding of the dream of the night before, especially since my wife, Miss Dukas, and Margot were present, though I could closely guess its meaning.

A Round Sun

Since Einstein at the time of my lecture before the Forum wished to be present, and later had to satisfy himself with the reports of the three females of his household (Gina Plungian could be counted as belonging to the household), I supplied him with a copy of it.

January 6, 1954

Dear Professor Einstein:

I have carefully put into writing my lecture before the Forum of the Graduate Students here (October 14, 1953). Doing so I was guided by the desire to place it before you for reading.

In the written form I have considerably shortened the archaeological and geological parts of my address; but I have elaborated on the astronomical part of it to a greater length than I did orally. Before submitting this paper to you I have asked Professor Lloyd Motz of the Astronomy Department of Columbia University to check its factual statements.

I am aware of the great demand on your time made by various authors; therefore have my sincerest thanks for agreeing to read this paper.

Cordially yours,

Immanuel Velikovsky

After a few days Einstein invited us to come and discuss my lecture. Thus the wall was breached. Until then, in our previous conversations that winter, neither he, nor I, mentioned anything of my *Worlds in Collision.* But during this visit of February 11, 1954 I turned to Einstein and said:

"Now imagine that the Lord sent a messenger to you with these words: ‘I gave you, Albert Einstein, a very unusual mind and, what is still rarer, the recognition and admiration of your contemporaries. Now build a working plan for another universe;

only don't apply gravitation that propagates at the inverse square, but electricity and magnetism you may use as much as you need.' Could you do this?"

"I would answer the Lord: 'Do such a thing yourself!'" Einstein burst into a loud laugh. But then he thought a few seconds and said: "Yes, on condition that it be a dark universe."

"Why?" I asked.

"The charge on the planets would be expended in the photoelectric process."

The problem he selected for discussion that evening, from a series of problems mentioned in my lecture, was the round shape of the sun. Because of rotation it should be somewhat flattened; and in addition the sun rotates at a greater velocity at its equator than at higher latitudes. We spent the evening talking about this and a few other points in my lecture; when my wife and I left, it was already late and Einstein's eyes were tired.

After a few hours of sleep, I awoke and jotted down my comments to various arguments Einstein had brought up, especially discharge by photoelectric effect. It appeared to me that this effect must *charge* a neutral body. In the morning I thought of calling Helen Dukas and saying a few words of apology for our too long conversation, when the phone rang and Miss Dukas said: "The professor would like to talk to you." His voice sounded resonant and clear, and I thought, if one does not see Einstein but only hears him, he may imagine that he is speaking with a young man. He said (as I recall):

"After our conversation last night I could not fall asleep. For the greater part of the night I turned over in my mind the problem of the spherical form of the sun. Then before morning I made light and calculated the form the sun must have under the influence of rotation, and I would like to report to you.

"Imagine the sun as a body one meter in diameter; because of the slowness of rotation—I took one rotation equal to 25 days—the deformity should be only"—I believe he said—"a quarter of a millimeter." While he was saying this I quickly calculated in my mind (in general, I am not quick at figures), that this would amount to about one half a second of the arc, the visible face of the sun being about half a degree, or 1800 seconds, and, in his opinion, this small difference could escape observation. I told Einstein his figure, translated into seconds of arc.

We agreed to inquire of Professor Lyman Spitzer Jr., Director of the Princeton Observatory, whether a difference was established in the length of the solar equatorial

and polar diameters.

February 19, 1954

Dear Professor Spitzer:

May I ask for an information? Is a difference established in the length of the equatorial and polar diameters of the sun?

This question came up in a conversation with Prof. Einstein and he thought it would be right to put this question to you.

Very truly

Immanuel Velikovsky

PRINCETON UNIVERSITY OBSERVATORY

14 Prospect Avenue
Princeton, New Jersey

February 26, 1954

Dr. Immanuel Velikovsky
4 Hartley Avenue
Princeton, New Jersey

Dear Dr. Velikovsky:

In reply to your letter of February 23 I am writing to say that there is no established difference in the length of the equatorial and polar diameters of the sun. Some observers have reported a small difference but I believe that no such difference has been firmly established.

Very sincerely yours,

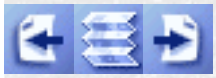
Lyman Spitzer, Jr.

I know that Dr. Donald Menzel even found an excess in the polar diameter which he was “loath” to consider.

In March the world paid Einstein a renewed tribute at the occasion of his reaching seventy-five years of age. His mail was coming in big sacks. I wrote him a quotation from Emerson:

> Beware when great God lets loose a thinker on this planet. Then all things are at risk. It is as when a conflagration has broken out in a great city, and no man knows when it will end. There is not a piece of science but its flank may be turned tomorrow; there is not any literary reputation, not the so-called eternal names of fame, that may not be revised and condemned. The very hopes of man, the thoughts of his heart, the religion of nations, the manners and morals of mankind are all at the mercy of a new generalization.

Einstein called by phone to express his thanks.



In Einstein's Study

On May 20, 1954 I went to see Einstein. This time I asked to see him. I wished to ask him to read a part of my *Earth in Upheaval* in manuscript. There was also another subject that I thought I ought to discuss with him. A few days before a correspondent in California drew my attention to an article in *Astounding Science Fiction* in which I was accused of inventing my sources. I realized the damage done by the Harvard group had spread into pulp magazines read by common people. I had not complained to Einstein before about the campaign of suppression and vilification carried on by some groups of scientists against my theory and myself.

He received us this time in his study on the second floor, which has a large window overlooking the garden in the backyard. It was about the time before sunset. He asked:

"Would you like our conversation between four eyes or between eight?"

"Between eight," I replied, my wife and Miss Dukas being admitted.

"The women will listen but not participate," he said, expecting something important to discuss with me.

"Like in a synagogue," I remarked. But then I corrected myself. "No, I feel myself here as Solomon Molcho must have felt in the palace of Pope Clement VII." I explained that this *marrano,* i.e, a Jew from a family that had been forcibly converted to Christianity, was sentenced to die for reverting to Judaism and was burned as a heretic in Rome by the Inquisition; but the next day he was alive in the inner chambers of the Vatican discussing philosophical problems with the Pope. The Pope had let another heretic be burned and hid Solomon Molcho. If only the Holy Inquisition knew *where* he was! This was my way of referring to what my opponents and detractors among the scientists might think and feel were they to know where I was spending that evening.

"Is he a gentleman who permanently turns his pockets out to show that he did not steal?" I quoted Vladimir Jabotinsky. I could not spend all my time proving that I have not misquoted or otherwise misused my sources. But silence on the part of the accused is understood as admission of guilt. Einstein agreed with me. And thinking of

injustice to a man, he mentioned Oppenheimer, whose removal from the advisory committee to the Atomic Energy Commission caused at that time great agitation.

"But you do not do better," I said. Einstein's face expressed surprise. "I do not think of you personally, but of your colleagues, the scientists." He wished to know more. I went down and brought from the car a file with some of the letters exchanged between Harlow Shapley and the Macmillan Publishers. He read them with great interest. But we did not proceed far enough; we had not come to read the letter of Whipple to Blackiston Publishers in Philadelphia, or the statement of Shapley in the *Harvard Crimson.*[1]

Einstein was obviously impressed and did not spare harsh words in characterizing some of the actors in the campaign of suppression.

Einstein advised me to make the material public. I should, he said, find somebody with a talent for dramatic writing and entrust him with the task of presenting the case. He was obviously impressed and indignant. "This is worse than Oppenheimer's case."

I mentioned that in Germany the church also opposed me, and in fact suppressed *Worlds in Collision* at the hands of its publisher (Kohlhammer of Stuttgart). As in America the book had a great success, and went through five printings in less than a year when the lid fell down.

"But what should the church people have against the book?" asked Einstein, and turned his face to me (as often during our conversations, he was sitting to my left). The opposition of the churches to a work that provoked furor among the scientists must have appeared to him incongruous. All this must have been thought, not said, for my answer followed immediately:

"The church opposed my interpretation of miracles as natural phenomena." Einstein laughed with his loud, hearty laugh. He wished to read more in the file. But now I was interested in taking up the problem that really occupied my mind—my theories.

Already at one of our earlier meetings, Einstein said to me: "I know how to explain the great global catastrophes that occurred in the past." He spoke then of vestiges of an ice cover that were observed in the tropics and referred to an unpublished theory of Charles Hapgood, who thought that growing ice caps can cause a slippage of the terrestrial crust relative to the interior, thus displacing the poles. This evening Einstein returned to the same idea and said that terrestrial causes could have been responsible for the catastrophes. I told him that the problem of the displacement of the terrestrial pole was already much discussed in the last century by astronomers and

geologists. “By whom and where?” he asked. “Here,” I said, about to leave, and showed him the second (of three) files of the manuscript of *Earth in Upheaval*, “Here you may find the arguments of that old discussion.” First he was reluctant to take another manuscript for reading. The daily mail alone takes so much of his time, he said, and standing at the top of the staircase, while I was a few steps down, showed with his hands how thick was the bundle of his daily mail. But, hearing that the physical problem of the terrestrial crust moving over the core is discussed in that file, he took my manuscript.

The next day I wrote two letters:

May 21, 1954

Dear Professor Einstein:

It may be that I said more than I was aright to say when yesterday evening I expressed myself that Einstein is humanly obliged not to be indifferent to the wrong that was and is still done by an organized group of scientists. But because of your position of a recognized leader among scientists and fighter for human rights, I feel obligated to you not to keep you uninformed.

These are two problems, entirely independent: Am I right in my theory? I am striving to prove it. Have I the right to express in writing the conclusions to which I came in an honest endeavor? Though the answer is elementary, this right was so mistreated that, following an attack this month, after some hesitation, I decided to ask more than just a few minutes of your most precious time.

With sincere regard,

Immanuel Velikovsky

May 21, 1954

Dear Miss Dukas:

Yesterday evening Professor Einstein wondered to hear that in my book the role of Venus in the catastrophe is deduced from direct references in the folklore of many peoples. I am sending to you, Miss Dukas, a copy of the German edition of Worlds in Collision; between the pages 170 (where Venus is for the first time mentioned in my book)

and 220 I have marked with pencil such references. Please, show them to Professor, if he likes to see them.

Professor wished also to see the passage concerning the solar eclipses before -687, especially one seen in China, with reference to Venus in the source. I have marked the passage in my reply to Stewart in Harper's. . . .

I enclose a few lines for Professor. I hope I have not tired him yesterday too much.

Cordially yours,

Immanuel Velikovsky

Two days after our meeting Einstein wrote me a long handwritten letter—which was rather unusual, since most of his letters were dictated and typed. He also returned my file and supplied some of the sections with numerous marginal notes.

22.V.54.

Dear Mr. Velikovsky!

Remarks on the part of your manuscript "poles displaced."

The first impression is that the generations of scholars have a "bad memory." Scientists generally have little historical sense, so that each single generation knows little of the struggles and inner difficulties of the former generation. Thus it happens that many ideas at different times are repeatedly conceived anew, without the initiator knowing that these subjects had been considered already before. In this sense I find your patience in examining the literature quite enlightening and valuable; it deserves the attentive consideration of researchers who according to their natural mentality live so much in the present that they are inclined to think of every idea that occurs to them, or their group, as new. *The* idea of a possible displacement of the poles as an explanation of the change of climate in any one point of the earth's crust is a beautiful example. Even the idea of the possibility of a sliding of the rigid crust in relation to the plastic, or fluid deeper strata of the earth, was already considered by Lord Kelvin (and was in fact rejected).

The interpretation of the vote mentioned on pp. 159-160[2] as an attempt at a dogmatic fixation of the "truth" is not obvious to me. It is simply interesting for the participants of a congress to see how opinions concerning an interesting question are divided among those present. I don't think that the underlying idea was that the outcome of the voting would somehow insure the objective correctness of the outcome of the vote.

From p. 182 on starts a wild robbers' story (up to p. 189) which seems to rely more on a strong temperament than on organized considerations. Referring to p. 191: Blacket's idea is untenable from a theoretical point of view. The remark about the strength of magnetization seems to be unjustified (p. 192); it could for example depend essentially upon the speed of cooling as well as on particle shape and size. The direction of the magnetic field during solidification must however quite certainly determine the direction of magnetization. Bottom 192 etc.: wild fantasy! from here on marginal remarks with pencil in the manuscript.

The proof of "sudden" changes (p. 223 to the end) is quite convincing and meritorious. If you had done nothing else but to gather and present in a clear way this mass of evidence, you would have already a considerable merit. Unfortunately, this valuable accomplishment is impaired by the addition of a physical-astronomical theory to which every expert will react with a smile or with anger—according to his temperament; he notices that you know these things only from hearsay—and do not understand them in the real sense, also things that are elementary to him. He can easily come to the opinion that you yourself don't believe it, and that you want only to mislead the public. I myself had originally thought that it could be so. This can *explain* Shapley's behavior, but in no case *excuse* it. This is the intolerance and arrogance together with brutality which one often finds in successful people, but especially in successful Americans. The offence against truthfulness, to which you rightly called my attention, is generally human, and in my eyes, less important. One must however give him credit that in the political arena he conducted himself courageously and independently, and just about carried his hide to the marketplace.

Therefore it is more or less justified if we spread the mantle of Jewish neighborly love over him, difficult as it may be.

To the point, I can say in short: catastrophes *yes*, Venus *no*. Now I ask you: what do you mean when you request of me to do my duty in this

case? It is not clear to me. Be quite frank and open towards me, this can only be good in every respect.

With cordial greetings to both of you,

Your

A. Einstein.

It took me seven weeks before I replied to him. With my first drafts I was dissatisfied. So many problems were raised that I could not possibly compress them into a letter of reasonable length. I decided on the strategy of challenging Einstein's contention that terrestrial, not extraterrestrial (astronomical) agents caused the global catastrophes.

I decided not to answer in a direct way his questioning my competence to handle physical problems and, instead, by presenting my arguments, intended to confront him with the measure with which I *can* handle these problems. I omitted to meet his challenge "Venus *no"*—in our debate this was premature; he agreed that there were global catastrophes, some in the memory of mankind; so next I had to show that only extraterrestrial agents could have been the cause, without identifying the agent.

June 16, 1954

Dear Professor Einstein:

During the three weeks since I received your kind letter, I have composed in my mind many answers to you, and made a few drafts. I realized soon that I would be unable to compress all the problems into one letter and I decided to try to achieve with this writing only one step - to bring you closer to the insight that the global catastrophes of the past were caused not by a terrestrial but by an extra-terrestrial cause. Before discussing this, I would like to say that I am very conscious of the fact that you give me of the most precious in your possession - your time; and I would not have asked to pay attention to these matters if I did not believe that my material may, perchance, serve you too, whatever your conclusions should be. My delay in replying you is certainly not an act of lack of attention; just the opposite - not a quick reply, but a well thought through is a real courtesy.

You agree that (1) there were global catastrophes, and (2) that at least one of them occurred in the not too remote past. These conclusions will make you, too, to a heretic in the eyes of geologists and evolutionists.

Eight years ago, in 1946, under the impression of those chapters of Worlds in Collision that you have read then in manuscript, you have acceded in a letter that “in der Tat Katastrophen stattgefunden haben, die auf extra-terrestrale Ursachen zuruckgefuehrt werden mussen."[3]

Now, without re-examining the material that made you think so, you would like to retreat from this position. On the other hand, in 1946 you have brought two arguments against my theory, namely:

(1) “Dass diese Katastrophen nichts zu tun haben mit dem Planeten Venus."[4]

(2) “Dass auch die Rotationstichtung der Erde gegenuber der Ecliptic keine erhebliche Aenderung hat erfahren konnen, ohne dass die ganze Erdkruste vollig vernichtet worden ware."[5]

It appears to me that today you keep no longer the second objection in that definite form; you presently assume that the terrestrial crust, rather catastrophically, moved over the interior of the earth; the experiences that the human kind must have had in such a plunge, would satisfactorily explain the phenomenon of the retreating sun (the cause of a great wrath in the days of Joshua and of Velikovsky as well), the change of cardinal points, of latitudes, of seasons and climate, and the inability of the ancient water- and sun-clocks to show correctly the time of today. It would, however, not explain the change in the number of days in the year, of which all ancient calendars (Maya, Inca, Hindu, China, Persia, Egypt, Babylonia, Assyria, Palestine, Greece, Rome) concur ("Worlds in Collision,” pp. 312-359: these pages would certainly impress you).

Against a terrestrial cause of
global catastrophes:

The surmise that an asymmetrical growth of polar ice caused in the past a sudden shifting of the terrestrial crust

(1) disregards all references in the folklore to the celestial phenomena accompanying the catastrophe: meteorites and “bursting of the sky,” also darkness.

(2) disregards the geological find of unusual concentration of meteoric iron and nickel in the ocean bed (I attach a section of my new manuscript, “The floor of the seas,” with a description of the work of M. Pettersson of Goeteborg Oceanic Institute).

(3) disregards the magnitude of the force necessary to move the terrestrial crust over the equatorial bulge. Ice covers of the polar regions are placed in the least favorable position to disrupt the balance. The seasonal migration of ice and snow from one hemisphere to the other never induced the slightest displacement of the poles. And finally, the most important counter-argument concerns the mass and the form of the terrestrial crust:

(4) “The data secured from observations . . . of the transmission of seismic waves indicate that the earth is either solid thoughout with the rigidity of steel, or that it is solid to a distance approximately 2000 miles below sea-level, with the solid portions having a rigidity greater than that of steel . . . This seems to indicate a contradiction between isostasy and geophysical data.” (W. Bowie, “Isostasy,” in *Physics of the Earth*, II, 104).

The theory of isostasy was conceived in 1851 when J. H. Pratt found that the Himalayas do not deflect the plumb line as expected considering the mass of the mountains. It was assumed that the crust is thin and lighter than the magma and that every mountain has a mirror image protuberance immersed into the magma, thus the excess of the mass of the mountains is counterbalanced by a defect in the mass (difference between the lighter granite of the crust and the heavier magma). This, however, would signify that in order to move the crust over the very dense magma (twice the weight of granite) the isostatic protuberances (besides the equatorial bulge) will present obstacles that cannot be overcome by an asymmetric position of polar ice. If, moreover, the crust is 2000 miles thick, its mass represents a very substantial part of the globe.

What are the arguments against an extraterrestrial cause of the global catastrophes?

Arguments against extra-terrestrial agents are:

1. Ancient solar eclipses would not have taken place in appropriate times. Answer: As shown in my answer to Stewart, there is not a single

case known where they actually did. By the way: the same argument, if true, would be good against the motion of the terrestrial crust in historical times.

2. Earth's axis of rotation would wobble: It does.

3. Things would have flown away if unattached: This depends on the time element.

4. Waves of translation and hurricanes would be generated: they were. A section from the first file of my geological work is attached, and explains, partly, the "wilde Raubergeschichte,"[6] in the (second) file you just read.

Argument against a massive comet: The observed comets are of small mass. In answer:

1. Even Jupiter, as all other planets, was once in the category of comets, according to the planetismal and tidal theories.

2. The origin of the terrestrial planets (Mercury, Venus, Earth, Mars) from the large planets (to explain the difference in the specific weights) is an old legitimate story.

Arguments against the mechanism of disturbance: A gravitational pull by a passing body could not disturb the rotational velocity of the earth or the inclination of its axis. Answer: In Worlds in Collision I brought historical material leaving astronomers to choose:

1. Either the earth was disturbed in rotation,

2. *or* the axis of rotation changed its inclination to the plane of the ecliptic.

Once more, I left for astronomers to choose: The earth was disturbed by entering

1. into a thick cloud of dust,

2. or into a magnet field.

In Worlds in Collision I left open the problem which of these mechanisms was in action (p. 386). You are indignant at the idea that magnetic fields had anything to do with the disturbances. You oppose such explanation

1. because magnetic actions are excluded from the celestial mechanics. Answer: At usual distances. But at close approaches the magnetic fields could be felt.

2. because in a cloud of iron particles there is no reason for all of them to have the same magnetic orientation. Answer: The same question is asked concerning the polarized light of fixed stars that supposedly passes through clouds of gases or dust particles. Also: would the earth, which is a magnet, and possibly has an iron core, moving through a large charged cloud of dust preserve the direction of its axis or not?

The real cause of indignation against my theory of global catastrophes is the implication that celestial bodies may be charged. It was argued that only an astronomer can imagine the degree of coincidence between the calculations based on the gravitational theory and the observed planetary motions. But this very degree of coincidence is disturbing in the face of many facts known about the sun (behavior of protuberances), the planets (influence of radio-transmission), the comets (self-illuminating; behavior of tails), the fixed stars (strong magnets), the meteorites (magnets). Even for the cases of observed anomalies magnetic or electric charges were not considered, as if they were a tabu in celestial mechanics. Of the many unexplained phenomena presented in my address before the Forum of the Graduate College, you have explained only the apparent spherical form of the sun (and was it correct to disregard the very low atmospheric pressure on the sun in calculating its expected shape?), but not why the sun rotates quicker on the equator, nor many other similar violations of mechanical laws.

Of course, I am a heretic, for I question the neutral state of celestial bodies. There are various tests that could be made. For instance, does Jupiter send radio-noises or not? This can easily be found, if you should wish.

If planets are charged, gravitation is a short range force, a terrible statement to make. Cavendish experiment with varying distances between the attracting bodies would easily disprove such notion. But if

I am not wrong, the Cavendish experiment is not performed in a Faraday cage. It should be easy to find out the constant in a cage. But not easy for me. Especially since Shapley in a relentless effort made me "out of bounds" for scientists.

You, too, would not have had any suspicion about my motives in my book on folklore and ancient literature, were it not for the campaign initiated by Shapley. The few pages on astronomy in my book were edited by Lloyd Motz, professor of astronomy at Columbia University. Too early you have thrown the mantle of Jewish compassion over Shapley: you have seen only the beginning of the file of the documents concerning the "Stargazers and Gravediggers" and their leader. His being a liberal is not an excuse but an aggravating cirumstance. My appeal to you to investigate this material was prompted by a new attack, a few days before I last saw you. Then I immersed myself in my work and calmed down.

Cordially,

Immanuel Velikovsky

My answer was written three weeks after I received his letter, but for an additional four weeks I postponed sending it to him. Then when my wife brought it (she went to see the new sculpture work of Margot), Einstein came in, and apparently was relieved of a thought that he had perchance hurt my feelings by some of his remarks. He read my letter immediately, and returned it and asked to see my *Worlds in Collision,* to which some references were made in my letter. Next we had a call and invitation to come and discuss the problems raised by my letter.

References

1. See *Stargazers and Gravediggers,* pp. 158-161.
2. pp. 117-118 of the book
3. "that in fact catastrophes have taken place which must attributed to extraterrestrial causes."
4. "That these catastrophes can have nothing to do with the planet Venus."
5. "That also the direction of the inclination of the terrestrial crust towards the ecliptic could not have undergone a considerable change without the total destruction of the entire earth's crust."
6. "wild robbers' story"

July 21, 1954

On July 21st, 1954 our meeting again took place in Einstein's study, and lasted for three hours, from 8:30 pm to 11:30 pm. When in our conversation I reminded him that in 1946 he had agreed that the causes of the global catastrophes were extraterrestrial, he answered:

"I was too rash to agree."

I replied, "Do you rely on your memory more than on your judgment?"—implying that he agreed when my material was fresh before him, and disagreed when he hardly could remember much of it.

Einstein still found attractive Hapgood's theory that ice covers growing asymmetrically caused the Earth's crust to slide. He wished to explain the catastrophes as the result of forces in the Earth itself. I asked how asymmetries of a few degrees could bring the ice covers to latitudes of 45 degrees where the crust would be the most liable to disbalancing. I also pointed out that his rejection of the theory of isostasy, which claims that mountain ranges rest on deep subterranean structures, undermines Hapgood's position about the sliding of the Earth's crust.

The conversation turned to my claim of the participation of electromagnetic forces in celestial mechanics. I said, "All the sciences—neurology, physiology, physics, and chemistry—recognize the overwhelming role of electromagnetic forces; only astronomy lives in an age before kerosene, in the age of candles." Einstein agreed with the thought I had expressed in my letter to him that it is my introduction of electromagnetic forces into celestial mechanics that caused the vehement opposition of the scientists. I explained to him that these matters are not discussed in *Worlds in Collision*, and read him a sentence from the Epilogue of that book:

> The accepted celestial mechanics, notwithstanding the many calculations that have been carried out to many decimal places, or verified by celestial motions, stands only *if* the sun, the source of light, warmth, and other radiation produced by fusion and fission of atoms, *is as a whole an electrically neutral body,* and also if the planets, in their usual orbits, are neutral bodies.

Penelope

During the fall of 1954 we did not meet due to Einstein's poor health. He was told by his physician, Dr. Dean, not to see people and to reduce much of his activity. Einstein also ceased going to the Institute. As I heard later, at that time, in the late summer and the fall, his blood condition deteriorated and could not but cause concern. The medical findings were not known to the public, not even to acquaintances; in general there was always a desire to keep personal matters out of the public view. Thus, for instance, once during the period I describe in this book fire broke out in Einstein's house, an old frame structure with a porch, staircase and partitions, all well dried and a little rickety, which could easily be enveloped by fire. It was a case of faulty wiring. When the flames broke out, Einstein, the only man in the house, beat the fire out singlehandedly, first closing the windows to cut off the fire from inflow of oxygen. By the time the fire brigade arrived, the fire was already out. Such an event, if known to newsmen, would certainly have made the front page; but it was kept secret, and the fire department cooperated. The house was rewired.

The gravity of Einstein's sickness was an equally well-kept secret. His mind was inquisitive, but he was deprived of exchange of thoughts. Later I was told that he repeatedly asked to see me; Miss Dukas, however, followed the doctor's orders and kept Einstein in isolation from all but his closest circle. To this circle belonged Gina Plungian, mentioned on an earlier page, the ebullient, warm, outgoing admirer of Einstein, who became like a member of his little household, almost like a fixture in the house. For seven years she sculpted Einstein's head, sitting as quietly as possible in his study while he worked, not saying a word in order not to disturb his thoughts, though this must have been a great privation to her, a great talker and an interested listener to the personal matters of her acquaintances. Einstein and others of his household used to call her, though not to her face, Penelope, because she used to spoil the likeness she had already attained in clay, like the mythological figure who used to unravel during the night the knitting she had done during the day in order to prolong the process—or did it only seem that way? Whatever were Gina's abilitites as a sculptor, she tried not to disturb, and all she asked was to sit quietly in some corner when Einstein worked. Some time earlier she and her family had moved away to Chattanooga, Tennessee, where her husband, a chemical engineer, obtained a position; yet Gina managed to come back, by plane or by bus, once in a while, whether the "while" was a month or a week. She would spend the night at our place, and the day at Einstein's. During the fall of 1954 I asked her to carry a letter to Mercer Street and bring back a reply. Giving her the letter to bring to Einstein, I

added a little note for her to read to him.

Knowing that he was still weak and not yet recovered from his severe anemia, I felt that I had to add a human touch to my unbending stand in the problem we discussed. The note read:

> And he said, “Let me go, for the day breaketh.”
> And he said, “I will not let thee go, except thou bless me.”

It is from the book of Genesis, from the story of Jacob wrestling with the angel; Jacob rose that night, on his return to the land of his birth, passed over the ford of the Yabbok, and was alone in the dark of the Canaanite night; “and there wrestled a man with him until the breaking of the day.” The angel did not prevail and asked that the struggle cease (“Let me go”), which Jacob refused to do unless his adversary would bless him.

That evening upon her return from Einstein and again at the breakfast table the next morning Gina told us that when she gave my letter to Einstein she, as instructed, read him from my slip of paper the passage that was intended to mollify the impression my intransigence could create. Einstein liked the passage very much. Of course he understood whom I likened to Jacob and whom to the angel. In good humor he observed: “But why should an angel be fearful of the daybreak? What kind of an angel is it?” During the day he returned to that verse from Genesis more than once, and at the dinner table he recounted it to Margot and Miss Dukas. But when in the evening Gina was about to leave—in the meantime he wrote his answer to my letter all along the margins—he called her aside and told her, in German as usual: “Please, don’t say to Velikovsky that I remarked about the angel. Possibly Velikovsky is a religious man, and this remark may hurt his feelings.” Gina told me and I was not hurt; just the contrary—I thought that this was an example of how Einstein was sensitive to the feelings of others. But it was still night, and the struggle had to go on. I was not giving in; I was actually the attacking partner of the debate; the case of the comet grazing the sun was the square on the chessboard which I selected for the encounter decisive for the campaign to follow.

A Comet Grazing the Sun

The problem between Einstein and myself was always the same, and we were equally obstinate: he because the mathematical model coincided with such unimaginable precision with the natural events, nowhere better observable than in the celestial sphere with the planets and their satellites on the prescribed paths; I, because it appeared to me that these exact coincidences between theory and nature had been achieved at the cost of a grievous omission—of electrical charges and fields. Natural catastrophes which I discovered to have taken place were my starting point, but these catastrophes were denied, and my description of the phenomena that accompanied them evoked the accusation that I had committed an outrage against the entire house of science. Yet even independently of what I read in ancient sources, historical or legendary, the picture of the solar system in which electricity and magnetism were absent and denied a role was strange to me. Once I read that the Jewish people produced the geniuses of Marx, Freud, and Einstein—the three men who so greatly influenced the world of today—because by the nineteenth century the Jewish people was mature in intellect, yet foreign to European scientific thought, and entered this domain when no longer novices in the house of learning, therefore more given to criticism, skepticism, and an original grasp of the content. If I saw things differently, it was possibly because I came in conflict with the accepted notions, being myself no longer a fledgling; I did not go through the normal process of studying geology or astronomy as a student in college, accepting everything on faith, subdued by the assertion that science in our days and since some time ago is finally on the right track, after periods of ignorance of the ancients and erroneous ideas of the pre-Newtonian days. I could not help seeing things differently.

I decided to select a case in which electromagnetic interrelations between two bodies in the solar system would be more apparent than elsewhere. Such a case would be in the passage of a comet very close to the sun, actually grazing the solar corona. In my understanding there would be a very pronounced case of electromagnetic interaction. Physical science, or, better, celestial mechanics, forbade such an interpretation—and why? Because as soon as electromagnetism is given right of entry, the entire solar system with planets and satellites would be engulfed in a forbidding sweep of forces and interrelations. If a comet that goes through the corona of the sun experiences some electromagnetic effect, then what about the same comet a little distance from the sun, before it reaches perihelion, or the point of nearest approach, or after it passes it? And if there, too, there should be some electromagnetic effect, then what about still greater distances and the behavior of cometary tails in general? Cometary

tails, as already mentioned on earlier pages, keep away from the sun: on approaching the sun the tail moves behind the head of the comet; at the time the comet circles the sun in perihelion, the tail sweeps the sky, almost like a stiff rod; and when the head retreats from perihelion and rushes on its orbit back into space, the tail precedes the head, again kept away from the sun. The behavior of the cometary tails is not in accord with what should have been expected on the basis of gravitational forces; the tails should be attracted to, not repelled by the sun. The problem was also in the minds of astronomers of the nineteenth century. John Herschel wrote:

> There is beyond any question some profound secret and mystery of nature concerned in the phenomenon of their tails; the enormous sweep which it [the tail] makes round the sun in perihelion in the manner of a straight and rigid rod, is in defiance of the law of gravitation, nay, even of the recorded laws of motion.[1]

But when at the beginning of the present century the Russian physicist, P. Lebedew, succeeded in demonstrating that light exerts pressure on the surface it falls upon, in agreement with the postulate of Clerk Maxwell, he wrote: “this result is of importance to astrophysics as furnishing a much simpler explanation of the repulsive force of the sun than the hypothetical ones of electrical charges."[2]

This pressure, or repulsion, is generally much smaller—in the case of the sun 20,000 times less—than the opposite action of the gravitational attraction; but calculation shows that on particles of dust of a certain small diameter the pressure of light will exert a greater force than will gravitation, and this because gravitation acts according to the mass, and pressure according to the surface, and a small particle has more surface in relation to its mass than does a larger particle. Although celestial mechanicians never really tried to investigate the problem quantitatively, the explanation was taken over into all textbooks. A quantitative analysis would show that the force needed to drive particles away from the sun at the speed observed must be between 200 and 2,000 times more powerful than the gravitational attraction exerted by the sun, instead of being 20,000 times weaker; (both act as the inverse square of distance—light and its pressure act four times weaker on an illuminated surface when the distance from the source of the light is doubled). A comet may have a tail as long as 100 million miles and thus reach all the distance from the sun to the terrestrial orbit, or even 200 million miles and thus reach past the orbit of Mars.

Finally, the cometary tails obviously have on one hand particles larger than dust grains and on the other hand they contain gases, but it is also obvious that light cannot drive these larger particles as it drives molecules of gases, and on this alone the argument capsizes—and leaves the behavior of tails unexplained.

The light of cometary tails is not just the reflected light of the sun; they glow by their own light, a fact established by spectroscopic analysis. It appeared to me that the comets are charged bodies, and possibly their tails and heads carry significantly different charges.

On the other hand the rotating sun, if it is a charged body, must create a magnetic field. Does not the corona when seen at full eclipse, or with the help of an occulation disc (coronograph), have the appearance of magnetic lines of force as they can be traced by the position of iron filings spread over a Compton paper, in the presence of a magnetic field? Then would not a comet going through the corona of the sun be subject to electromagnetic interactions? Further, is not a comet held away from the sun by its magnetic field? But if comets are subject to electromagnetic forces when close to the sun, they may be subject to the same forces when at some distance from the sun, too; and if comets respond to forces besides gravitation, are not the planets also responsive to some—large or small or minute—but *some* influence emanating from the sun, besides gravitation, namely of electromagnetic nature? The consequences are innumerable: is space empty, or filled with fields and influences? This is a question not unlike the question in theology: Is there or is there not a God? But now I was like a chess player sitting opposite the world champion, I being just an amateur, a beginner, plotting my attack. I moved a pawn—but I placed it in such a position that the champion immediately grasped the implications of my strategy. Let this move stand, and one by one, the bishop, the castle, the queen, and the king himself would all be under attack. The pawn could not be left in its threatening position.

You can take a pawn from the board if you have a piece in position to do this, and if the consequences will not be harmful; Einstein made his move. It was contained in the remarks he made to a letter I wrote him on September 17, though I did not send it until eight weeks later, with Gina Plungian. I included a note for Miss Dukas. Einstein's handwritten marginal annotations on my letter are here given as footnotes.

November 12, 1954

Dear Miss Dukas:

Enclosed is a copy of my September letter, retyped double-spaced for easier reading. At the end of it stands a question which has far-reaching implications. This is a logical move on my part in our extended discussion, and when Professor feels inclined to answer and his health permits, ask him, please, to dictate whatever he has to say to the problem.

With cordial regards

Immanuel Velikovsky

September 17, 1954

Dear Professor Einstein:

May I renew our discussion? At our last long conversation on July 21, you have acceded that the cause of the global catastrophes of the past could have been extra-terrestrial.[1]

You have found the behavior of Lexell's comet almost unbelievable.[2]

The next step in my strategy is to show that the comets do not revolve as neutral bodies around a neutral sun. I quote from H. Spencer Jones:

"The presence of bright lines in the spectra [of comets] can only be due to a self-luminous body. . . . the electrical phenomena obtained by discharge through a Gessler's vacuum tube enable the assertion to be made with a high degree of probability that the comet's self-luminosity is due not to an actual combustion, but to an electrical phenomenon."[3]

More facts point to a charged state of the comets. The envelope (coma) of a comet contracts with the approach to the sun and expands with recession, though in the heat of the sun the reverse could be expected.[4]

"There is good evidence that all particles in the comet influence the motion of each other. The configuration of the streamers in the tails . . . strongly indicates a mutual repulsion." (N. Bobrovnikoff, "Comets" in *Astrophysics*, ed. Hynek, 1951, p. 328).[5]

As to the sun: "Certainly the formation of coronals over centers of attraction and sunspots can be caused by the extended electrical fields of these areas of the sun; just so, coronals can be formed by the electrical fields about the end of a moving prominence." (E. Pettit, "The Sun and Solar Radiation," *ibid.*, p. 296).[6]

When prominences on the sun were observed to run one into another, "both prominences participating in the action recoiled violently . . . Strong electrical fields of the same sign might explain the

phenomenon." *(Ibid.*, p. 297).[7]

As to the spherical shape of the sun, the measurements were carried to one hundredth part of a second of an arc, and no departure from spherical shape was observed *ibid.*, p. 260); the admitted error of observation could not exceed a tenth of a second.[8]

Should we now assume that a comet moves in perihelion without experiencing an electromagnetic effect between itself and the sun? [9]

Cordially yours,

Immanuel Velikovsky

[1] [E.: I saw at that time no other possibility for a quick change of climate at any point of the Earth's crust. But since the mobility of the crust as against the main body is probable, so is an explanation for such phenomena based upon itself much more plausible than the assumption of an extra-terrestrial cause.]

[2] [E.: As far as the comet is concerned, you have unjustly claimed that it orbited Jupiter for a certain time; this possibility I disputed. In fact, through disturbance by Jupiter the comet repeatedly experienced a strong change in its course, without being "caught" by Jupiter.]

[3] [E: This is very vague and has nothing to do with the actual problem of motion.]

[4] [E: This is a quite superficial way of inference. One would have first to show that the phenomenon cannot be explained through an independent movement of the tail, without assumption of specific forces.]

[5] [E: A mere assertion.]

[6] [E.: Vague assertion.]

[7] [E: This is quite possible with formations which consist of (one-sided) charged ions.]

[8] [E.: Weak explanation! On this one cannot build. It would be

interesting to know what other specialists think of it.]

9 [E.: Yes. Otherwise Kepler's third law would not be valid.]

The best I could wish was that Einstein would cede me the point; and the next best that he would answer as he did; thus he documented the position of science on the issue in 1954. Four years will pass and it will be admitted that the pressure of light cannot, by a factor of 200 to 2,000, be the cause of the repulsion of the cometary tails[3];

the time will come when scientists will think it elementary that a comet crossing the solar corona could not escape electromagnetic effects; but by then it will appear self-understood that this is as it should be; and then I will need to prove that not so long ago different notions prevailed; and how much easier it will be if a man whose authority is unmatched should have written the verdict of science on the very document in which I claimed a divergent view.

Johannes Kepler, mentioned in my letter and in Einstein's notes, the discoverer of the three laws of planetary motions known by his name, was a man to whom Einstein felt a special sympathy, even affinity.

I was obstinate. I was determined to face the issue squarely on this most obvious case—of a comet going through the corona of the sun. And I had to answer the reference on Einstein's part to Keplerian laws.

January 11, 1955

[sent January 18]

Dear Professor Einstein:

Am I right or wrong in the following: A comet grazing the sun can experience an el.-magn. effect without violating Kepler's 3rd law,[1] because:

1. A static potential difference between the sun and a body on an orbit would also produce an inverse square relation which can be hidden in the gravitational effect.[2]

2. The magnetic component of the effect would produce acceleration. And actually an unaccounted for acceleration is observed in comets

passing close to the sun; this effect was studied on Comet Encke. (J. Zenneck, 'Gravitation' in *Encyclop. d. Mathem. Wiss.* vol. V, part I, p. 44).

3. Even assuming a comet as a neutral body partly consisting of ionized gases, and a solar protuberance as a collection of ions of one sign on a neutral sun, we would have in a grazing comet a conductor passing through an electrical field.

By the way, Kepler himself regarded the motion of the planets and comets on ellipses as originating wholly in the sun, and for a time thought of magnetic action (electricity was not yet known; but Gilbert's book on magnetism already appeared in 1600). Kepler wrote:

" [Sol] trahendo et repellendo retinet, retinendo circumducit" *(Opera omnia,* VI, 345).

Actually Kepler's idea of a magnetic field reaching from a primary to a satellite can be checked as follows:

If the lunar daily librations in latitude follow the rotation of the polar magnetic field of the earth around the geographical pole, then the magnetic field of the earth reaches sensitively to the moon. Among lunar daily librations are some unaccounted for. According to H.T. Stetson of M.I.T., a magnetic needle slightly follows the sun.

As to Lexell's comet: It was removed by Jupiter from a parabolic orbit to an ellipse of 5½ (five and a half) year period, and at the next passage it was sent away on a hyperbolic orbit. This I mentioned; you have thought it impossible, even after reading this in Newcomb's astronomy.[3]

You have asked me: what do the specialists say about the shape of the sun. I quote Donald Menzel of Harvard Solar Observatory *(Our Sun,* 1950, p. 39): "but the measures are as likely as not to indicate a *polar* diameter greater than the equatorial, which we are indeed loath to believe."

With all good wishes,

cordially,

Im. Velikovsky

[1] [E: No, that would be a miracle. If the forces of the solar system were of an electrical nature then for instance the following would occur: if the sun were charged positively, then the earth would have to be charged negatively, and the moon again positively. The sun would then repel the moon, so that the moon's motion would deviate considerably from the factual. Kepler's third law which connects periods of revolution and the radii of orbits of planets revolving around the sun would not be valid because the charge of each of these bodies would be independent of the charge of one another.]

[2] [E: It is not enough for the understanding of Kepler's *third* law.]

[3] [E: No, you have stated that the comet was for a time captured by Jupiter. Only this I declared impossible.]

Einstein also appended the following postscript to my letter:

Nobody denies electromagnetic effects between the heavenly bodies. But these are too small to assert themselves upon the observable motions. With qualitative considerations only, one can achieve nothing against keen quantitative perceptions.

When an astronomer hears such arguments as yours, and he has not enough sense of humor, then he necessarily will be angry or rude.

That the sun cannot have any appreciable electrical charge can be seen from the following elementary consideration. The radiation of the sun generates positive and negative ions in its atmosphere. If the sun was originally (for example) positively charged, it would have repelled the positive ions and hurled them into space. Thereby its positive charge would be reduced. This process will last until the sun will have lost its positive charge. This consideration is likewise valid for negative charge.

The solar radiation produces also enough ions on the surface of the planets and moons for a charge to disappear in a short time.

Finally, if gravity were of an electrical nature, then a body would have to lose its weight as soon as it touches the earth, or is brought into conducting contact with it.

References

1. *Outlines of Astronomy*, p. 406.
2. Peter Lebedew, "An experimental investigation of the pressure of light," *Annual Report of the Board of Regents of the Smithsonian Institution* (Washington, 1903), pp. 177-178.
3. Ludwig Biermann and R. Luest, "The Tails of Comets," *Scientific American*, October, 1958.

The Four Plans of the Universe

During the winter Miss Dukas informed me regularly of Einstein's progress. When he recovered a little he wrote notes to my letter of January 11, and as usual covered the margin of my letter and its back with his handwritten notes. From his answer I felt that I had not yet made myself sufficiently clear, all my discussions with him being up to now more in the nature of prolegomena. At the end of February 1955 I wrote a thirteen-page letter where I stated most of the problems concerning the nature of gravitation and inertia, and discussed the difficulties and the advantages of four plans of the universe. I reminded him of my challenge to him made over a year earlier, to construct a plan for a new universe in which gravitation and inertia would have no part. This time I wrote in German, in order that it should be more comprehensible to him, though it proved to be by far more difficult for me to express myself in writing in this language after years of disuse.

February 2, 1955

Dear Prof. Einstein:

All I wanted in my last letter to you was to gain the concession that a comet, going through the corona of the sun or through an outburst of ionized gases, sustains an electromagnetic effect. The consequences of opening the gate to such an effect into the heavenly mechanics force the astronomer to disregard physical experiences, in order not to violate in the least the system of 1666. But in fact the comets do not follow precisely Kepler's third law: those that pass near the sun (like Encke's comet) show acceleration unexplained by gravitational mechanics.

My knowledge is not great, yet gravitation with static electricity I do not identify, as you understood me and then refuted me with the fall of a body which must discharge itself upon touching the ground. In the following I present my thoughts about the nature of gravitation and discuss also in short—more in the form of questions—the four systems of the world, of which the first is the Newtonian, and the second actually does not violate the Newtonian.

Do you remember how I asked you: If the good Lord would give you the task to conceive a plan for a new universe, where gravitation of the

inverse-square variety takes no part, would you be able to comply? To Newton He could not have made such a proposition, since Newton had only a very vague idea of electricity. However, the sentence with which he concludes the “Principia” is very interesting. I let this sentence follow as a supplement.

Enclosure 1

The end paragraph of the PRINCIPIA by Newton

But hitherto I have not been able to discover the cause of those properties of gravity from phenomena, and I frame no hypotheses . . .

And now we might add something concerning a certain subtle spirit which pervades and lies hid in all gross bodies; by the force and action of which spirit the particles of bodies attract one another at near distances, and cohere, if contiguous; and electric bodies operate to greater distances, as well repelling as attracting the neighboring corpuscles; and light is emitted, reflected, refracted, inflected, and heats bodies; and all sensation is excited, and the members of animal bodies move at the command of the will, namely, by the vibrations of this spirit, mutually propagated along the solid filaments of the nerves, from the outward organs of sense to the brain, and from the brain into the muscles. But these are things that cannot be explained in few words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic spirit operates.

[end of the *Mathematical Priciples*; transl. by F. Cajori]

Plan 1

Newton’s plan in which the heavenly bodies in their movements are influenced only by gravitation (and in a very small measure by light pressure). For this plan speak:

a) The simplicity of the law of gravitation. (The simplicity would be more complete if the same system would also be in action as the dominating force in the atom, and if gravitation, like all other energies in nature, were given to transformations).

b) The exactness with which the positions of the planets are predicted.

(The exactness of Ptolemaic astronomy in predicting eclipses and conjunctions was superior to that of Copernicus; and still the geocentric system is false).

c) The discovery of Neptune and Pluto (Neptune's position, but not its distance from the Sun was calculated in advance; Pluto's mass is by far not sufficient to explain the disturbances it causes).

Some of the circumstances which cannot be explained, or only with great effort, are:

1. The Sun, Jupiter and Saturn rotate quicker on their equators; the rings of Saturn rotate quicker than the planet. The inner satellite of Mars revolves quicker than Mars rotates; the sun possesses only 2% of the "angular momentum" of the solar system.

2. The Sun's protuberances *gain* in speed with the distance from the Sun. They fall back as if attracted to the place from which they erupted, falling back (as if on a rubber band) to the sun without acceleration.

3. The Sun's equatorial diameter is equal to, and in the consensus of other observers is 0.038 seconds of the arc smaller than the polar diameter (and to this says Menzel: "We are loathe . . .").

4. The tides caused by the Sun in the Earth's atmosphere are 16 to 20 times greater than those caused by the Moon.

5. The Moon and [some] other satellites always show their planets the same face.

6. The comets' tails are turned away from the sun and move in perihelion with a speed approaching the speed of light; no attempt at quantitative calculation has been made in this direction.

Plan 2

The heavenly bodies are held in their orbits mainly by gravitation; however they are not neutral.

Since static electricity also acts according to the inverse square law, its presence is masked by gravitation. From this follows: The masses of the heavenly bodies are not exactly calculated.

This plan can explain satisfactorily most of the difficulties of Plan 1. For this Plan 2 speak also, among others, the following facts:

1. The Sun too has a general magnetic field the strength of which is estimated very differently—the difficulty lies in the angle of observation. The corona has a form which resembles the lines of force of a magnetic field and extends far out.

2. In several stars a strong magnetic field (7000 gauss) has been detected. These stars must also be electrically charged because electrical currents would hardly occur on hot stars. The movement of two members of a double star system which rotate around each other in a few hours must probably be affected by more than just gravitation alone.

3. The earth is a magnet. The earth is enveloped in electrical layers of the ionosphere. Chapman postulates a strong electrical layer high (12,000 to 16,000 miles) over and around the earth.

4. The planets Mercury, Venus, Mars, Jupiter, Saturn, clearly influence our ionosphere and radio-reception; Jupiter and Saturn also have a connection to the origin of the sunspots.

5. The polar lights consist of electrical charges which come from the sun and which, after eruptions on the sun, or after the passage of a big sunspot, influence radio transmission and ground currents, and cause magnetic storms.

6. Meteorites are magnetized without exception. Also, upon entering the atmosphere they are regularly diverted toward the east and sometimes even seem to be hurled out after they have already penetrated into the atmosphere.

7. The fact that comets glow in cold space (lines of emission), and also the contraction of their heads when closer to the sun, speaks for an electrical effect.

8. A rise and fall in the strength of mutual disturbances between Jupiter and Saturn in the years 1898-99 as opposed to that of the years 1916-17 (18 % difference: J. Zenneck, “Gravitation” in *Encycl. der Math. Wiss.*, vol. V, first part, p. 44), speaks also for this and the following plans.

As to the argument that the photoelectric effect of the sun would neutralize the charges on the planets, I would like to ask: Would not the photoelectric effect cause charges on neutral planets? And why is not our ionosphere neutralized by the photoelectric effect?

The other argument against this plan is in the assumption that the sun cannot be charged because it would repel the surplus ions. I would answer: According to spectral analysis, the atoms on the sun have been left without many, often without any orbiting electrons. Could not the electrons which have left the protons in their closest proximity where the attraction is tremendous, also have left the sun entirely? Actually the sun hurls out charged particles (polar lights, also cosmic rays) as if it were charged and would like to reach a neutral state. (However the sun, charged as it is, changes its charge imperceptibly: were it not so, then the system would constantly change its paths.)

Another reply: In the atom the same problem exists: how can charges of the same sign hold together in the nucleus?

Now a third reply: The stars, which are strong magnets, must also be electrically charged, because no electrical currents can exist at such temperatures. Why do the surplus protons or electrons stay there? And if there, then probably also on the sun.

And finally: Should we not, instead of considering the sun as neutral, rather consider the whole solar system neutral, with a surplus of charge of one sign on the sun and of another sign on the planets?

Plan 3

Gravitation would be a force which quickly diminishes with distance. Static electricity would be the dominating force between the heavenly bodies.

This would mean that the force which we know from our experience on earth as gravitation does not effectively reach the moon.

Against such an explanation speaks the fact that the Cavendish experiment under different conditions and distances between mutually attracting masses always showed the same results. However, as far as I can judge, this experiment was not performed in a Faraday cage; at the

same time we know that the atmosphere has an electric potential and that the potential difference strongly increases with distance from the ground, but probably could be almost identical in different laboratories.

This plan of static electricity as the dominating force between the heavenly bodies would explain most of the phenomena which are unexplainable in plans 1 and2, but against it speak the following facts:

1. In the case the planets are all of the same charge (positive or negative), they would repel each other. But would they not behave like two parallel conductors which attract each other when their currents flow in the same direction?

2. If, for instance, the sun is positive and the earth negative, then the moon would again be positive, and the sun would repel the moon.

Plan 4

In this plan, too, gravitation would be a force which diminishes rapidly with distance. Planets, satellites, and comets are charged bodies which move in the magnetic field of the sun, and which themselves create magnetic fields.

This plan would explain:

a. The retrograde movement of various satellites and comets;

b. the distribution of angular momentum;

c. the behavior of cometary tails; also the fact that comets are attracted to the sun from great distances, but were never seen falling into the sun, even though they are unstable in their orbits;

d. the position of the moon and other satellites which continuously turn the same face to their planets;

e. the energy of cosmic rays;

also the fact that the sun is hotter in the corona than in the photosphere; and several other facts.

Since magnetic force decreases quickly with distance, the heavenly bodies must be differently charged in order to obey Kepler's laws. The planets which are further away from the sun must have a correspondingly stronger charge. This would be analogous to the arrangement of electrons in the atom. It would also explain the disturbances caused by Pluto, the mass of which is by far not sufficient to explain such perturbations.

Against this (4) plan speak the enormity of electric and magnetic forces necessary to make this plan effective.

The sun moves in relation to the stars; it rotates; the charged planets revolve around the sun, and create a Rowland magnetic field. How does the magnetic field between the sun and the planets behave, and how quickly does it decrease? (The calculations which I received from several young physicists differ greatly and go all the way from 1/r to $1/r^4$).

But above all, are the physical experiences of laboratories always applicable to the sky? There, a very great and hot mass of gases moves in the coldness of space; how would the magnetic field behave under such conditions?

It is apparent that plans 2 and 4 sin less against facts and observations than do plans 1 and 3. In order to decide between plan 2 and 4 the Cavendish measurements between impeccably neutral bodies must be repeated. But how impeccably? The electrical repulsion between two protons is 10^{40} times stronger than their gravitational attraction.

With cordial greetings,

Yours

Immanuel Velikovsky

[It should be noted that during the last two decades or so of Velikovsky's life, the ideas that had been expressed in **Cosmos Without Gravitation** *and in the fourth of the "Four Plans of the Universe" no longer reflected Velikovsky's approach to the extent that they once did. In particular, he backed off considerably from the idea of circumduction as a non-gravitational, non-inertial account sufficient in itself to*

explain orbital motions, and he also backed off from any general suggestions that gravity and inertia might somehow be banned from the celestial arena. What he often said in his later years was, not that gravity and inertia played **no** *role, but rather that they did not play the* **only** *role, that is, that gravity and inertia were not* **alone** *responsible for what occurred in the celestial arena: electromagnetic interactions also played a considerable role in cosmic events—especially when celestial bodies were in close approach to each other, but also even when they were far apart.*

The Space Age brought the myriads of artificial satellites that orbit Earth on different planes and in different directions. Clearly Earth with its magnetic field does not "circumduct" these artificial satellites around itself in a common plane, nor is it able to control their direction of movement. In such cases, some of the lesser variations and perturbations might still be attributed to electromagnetic factors, but gravity and inertia would remain the principal determining factors. It was no doubt such considerations as these that led Velikovsky to change his stance here. In any case, each of "The Four Plans of the Universe," even the fourth, should be taken as a "construction," a working hypothesis for the purposes of discussion, not as a final position. The same is true of **Cosmos Without Gravitation:** *not all of the ideas that were formulated in that early monograph were ones that Velikovsky continued to adhere to in his later work.*

Nevertheless, it must be emphasized that Velikovsky did not ever abandon the idea that gravity itself might eventually be interpreted as an electromagnetic phenomenon, nor did he ever abandon the idea that the solar magnetic field might to some extent be responsible for the fact that the planetary orbits are roughly co-planar and for the fact that all nine of the major planets, and apparently all of the minor planets as well, orbit the Sun in a counterclockwise direction.—Lynn E. Rose]

March 4, 1955

In the beginning of March Einstein started again to visit the Institute; a call came from him through Miss Dukas: would we not come that evening?; he would like to discuss my letter.

Einstein was in his study, his feet wrapped in blankets, and an electric heater burning close by; he stood up in an attempt to bring us blankets too, though it was not cold in the room. A glass of water was on the table in front of him. I had not seen him since he became sick over a half year earlier. His face was rounder, his composure was mellower. He would not argue as vigorously as he usually did, and less often laughed his uproarious laugh.

He read my letter aloud, line after line, and discussed it; he read with great relish the page of Newton's that I included—the very last page from the *Principia*, where Newton made a prophetic statement concerning the role of electricity in nature; and we discussed Newton's discoveries, and the discoveries of Kepler of the ellipticity of planetary orbits. Einstein read my explanation of gravitation as a dipole, but could not see how I explained inertia; of his own work he thought this was the greatest achievement, his stressing the equality of gravitational and inertial masses (I quoted de Sitter that Newton himself regarded this equality as a remarkable coincidence).

We succeeded to read only up to page 9 in my letter—it became late, and although Einstein was prepared to go on reading and discussing, I asked to postpone this in order to spare him. Thus we interrupted the session after plan 2, at about 10:30, after two hours. At the end Einstein told me that I am not given to change of mind.

In general Einstein was on the defensive—insofar as he had to deny many facts and explanations that are accepted in astronomy: he saw the consequence for celestial mechanics where the people who formulated the theories did not see them. In our discussion I mentioned for instance that the unusually high energy of cosmic rays is explained by the existence of magnetic fields in which, as in a cyclotron, charged particles are accelerated in the solar corona, whirled to very high energies. But if there is such a field, the earth, a magnet, must also experience an effect as it travels through it—an argument that came to my mind on the way to Einstein's house that evening. Seeing this consequence, Einstein denied the existence of such a field; the other explanation, that cosmic rays achieve their energy because they are accelerated by a charged earth, certainly did not help him out of the difficulty: therefore he stated

that we do not know what causes high energy cosmic rays. The circumstance that the sun rotates more quickly at the equator than at higher latitudes Einstein thought to explain possibly by some thermal effect. But the same phenomenon is observable on Jupiter, and he wondered that Jupiter is cold; could it not possibly be hot? Are not its satellites illuminated by it?

As to comets'' tails, Einstein expressed his disbelief in the high velocities achieved by the tails, and when I referred to John Herschel and W. Pickering, he wished to see the statements. After a few days I mailed these statements to him:

March 7, 1955

Dear Professor Einstein:

I thank you again for the discussion of the first 8 pages of my letter. Here are the quotations from John Herschel and W. Pickering I have mentioned in our last conversation:

"There is beyond any question some profound secret and mystery of nature concerned in the phenomenon of their tails"; "enormous sweep which it [the tail] makes round the sun in perihelion, in the manner of a straight and rigid rod, is in defiance of the law of gravitation, nay, even of the recorded laws of motion."

J. Herschel, *Outlines of Astronomy*, p. 406

"What has puzzled astronomers since the time of Newton, is the fact that while all other bodies in the sidereal universe, as far as we are aware, obey the law of gravitation, comets' tails are clearly subject to some strong repulsive force, which drives the matter composing them away from the sun with enormously high velocities."

— W.H. Pickering, article "Comets" in *Encyclopedia Americana.*

Cordially yours,

Immanuel Velikovsky

I cannot say differently: I became strongly attached to Einstein, as a son to a father, and I felt warmth coming in his feeling toward me. He said also that he too had almost everyone opposing him, but it is harder to tangle with them than with me—they would go into mathematics.

March 11, 1955

This evening, as one week earlier, and even more so, Einstein was of unusual concentration. We read the second half of my paper "On the Four Systems of the World." We sat at the round low table in his study, he at my left, not in an easy chair as he was wont, light shining on the paper that we read passage after passage, stopping and discussing. We started at 8:30 and continued till after 11:15, for two and three quarter hours. This time, in order to keep Miss Dukas awake—her fatigue was usually the cause of our breaking up—I brought with me the first of the three triple-ring binders with "Stargazers and Gravediggers," the story of the suppression of *Worlds in Collision*; I did not intend it for Einstein but for her, to have my discussion with Einstein unburdened by the usual sight of Dukas, vivid at the beginning of a session, but tired after a day of the many chores of both the household and the secretarial work, when it was close to eleven o'clock. She and my wife were regularly present at our meetings, she (Dukas) rarely leaving the room. She was usually interested in what was talked about, but not in physical problems—and on one of the previous evenings, when Einstein and I were concentrating on reading my paper, she said to my wife: "*Dies sind für mich Bömische Wälder*"—or "These to me are Bohemian forests"—impenetrable woods with no path through them, an expression of utter unfamiliarity with a subject. For an intelligent person associated with Einstein for twenty-five years this actually was a bit of insecurity that should have been overcome; it is a fact that she could carry on intelligently Einstein's correspondence.

Now she was immersed in reading the account of my experiences. In the quiet atmosphere of the evening, with no exchange of sentences between Dukas and Elisheva, no telephone calls, no doorbell rings, Einstein and I took up passage by passage. That evening we read the third and fourth systems. The third system—the one which has the sun, planets, and satellites carrying static electrial charges, providing the mechanism of attraction, was included for the sake of completeness; the argument that if the sun attracts the earth because of the opposite signs of their charges, it would repel the moon which, in such a plan must have a charge of a sign opposite to that of the earth, but of the same sign as the sun, disposes of this system; it is an obvious argument, and it was also used by Einstein in one of his letters when he did not suspect that my own interpretation of the electromagnetic effects in the solar system was similar at least in some respects to a rather different model, which model was presented as the fourth system. According to it, the central body—the sun—carries an appreciable charge, and by rotating creates an extended electromagnetic field; charged planets move through the field—or are carried by it;

those that rotate create magnetic fields and their satellites move through them; their motion is counterclockwise, or clockwise, depending at least in some cases upon the sign of the charge.

Einstein was obviously greatly interested and intrigued by the fourth model. When reading the text we encountered the issue of the decrease of the intensity of a field issuing from a dipole, as the inverse cube of the distance, which would require a greater charge for planets more remote from the sun in order that the overall effect should still follow the inverse square law, and by way of analogy I mentioned that this is the arrangement in the atom, where the electrons on external orbits carry more energy than those on internal orbits; Einstein's face immediately lighted—he was obviously struck by the analogy. This lighting of the face I observed twice that evening: it was as if a hunter suddenly perceived his game.

"And why do you need gravitation at all?" asked he, obviously fascinated by the model. But immediately he corrected himself: "Oh yes, in order to account for the phenomena on earth."

It is immaterial whether Einstein thought, as it appeared to me, that there could be truth in this system of the world; as a theoretician he was obviously fascinated by the model. It certainly appealed to him as a construction. Actually, I was presenting him with what I challenged him to produce at a meeting over a year earlier: "I gave you, Albert Einstein, a very unusual mind and, what is still rarer, the recognition and admiration of your contemporaries: Now build a working plan for another universe; only don't apply gravitation that propagates at the inverse square, but electricity and magnetism you may use as much as you need." "And why do you need gravitation?" he soon asked again, and again trapped himself—"yes, because of the terrestrial phenomena."

For the second time his face uprighted and lighted up when I mentioned that in this system the satellites, depending in part on the sign of their charge, revolve directly (counterclockwise) or retrogradely (clockwise).

His concentration that evening, the omission of counter-argument on his part, usual in our debates, and the great delight that he experienced in reading for three hours the few pages—the second half—of my paper, made us feel closer to each other than at any other meeting. And it was this that made him say at the end of that evening: "I think that it is a great error that the scientists do not read your book—there is much that is important in it" ; and even more, that made him confess to me that among the scientists he had met during his lifetime he valued completely, as a human being, only one man—Lorentz of Holland, all others having shown human deficiencies. He expressed himself strongly, and it was a surprise to me that he, regarded by all as so

humane and so forgiving, in his unique position which brought him recognition and admiration from everybody, should be so severe a judge of the human nature of all the scientists he knew, famous and obscure. He was standing, animated, telling me what, possibly, he had never said to any outsider; yet Miss Dukas, who was kept awake during the quiet evening by reading my “Stargazers,” now by her response to Einstein’s words displayed her knowledge of his attitude. Experience had taught him to regard his fellow men with suspicion and to see their moral inadequacies—it sounded almost as if he were a misanthrope, and this suprised me greatly; but I also felt that he was taking me into his confidence as he had possibly never taken anybody of the outside world. He was certainly very good to me that evening; I felt some tie of great tenderness, and goodwill, and confidence.

"A theory,” he said, “has a much greater chance for acceptance if it can predict a phenomenon” ; with these words he parted with me and then he went down the stairs to the door to press my hand again; he said also something about how he enjoyed the evening with me. In his words about a theory attaining success if it can predict a phenomenon was clearly a wish that I should be able to produce such a prediction, and there sounded a sincere desire that my theory should prove true.

I felt as if Einstein blessed me that night. “And he said, Let me go, for the day breaketh. And he said, I will not let thee go, except thou bless me.” I probably did not think of these words that I had sent him several months earlier; but I felt an achievement: after all these months of debate about the participation of electromagnetic forces in the working of the universe, now for the first time I had made him understand how I envisaged the plan. The classical plan was compromised by evidence; the static electricity plan did not stand up against argument; but the other two plans—in both of which electromagnetic effects take part in varying degrees—vie for the position of the true system of the world. Now he knew that I was not contemplating a model in which electromagnetism played a static role of attraction and repulsion, but one in which it played predominantly a dynamic role. I presented my discourse in the dispassionate terms of a brief review of four contestants, and left it to reason, calculation, and experiment to make the selection.

The magnetic field of the earth, the origin of which is a mystery, would be a direct effect of a charged body in rotation; the great, almost unimaginable energies measured in billion billion electron volts with which some cosmic rays approach the earth could be explained by the magnetic field in space but especially by the charge of the earth—and in consequence, the linear acceleration experienced by these ray-particles.

I certainly left Einstein with food for thought that night.

The Last Letter

On March 14, 1955, Einstein completed his 76th year. He was adored and admired by all literate humanity as possibly no scientist before him, also admired for his human qualities, regarded as almost divine; but he was a lonesome man. Letters arrived daily at 112 Mercer Street in scores, from great men of the age and from humble ones; from politicians, scientists, and cranks. He liked to receive these letters. Einstein had experience with people who misused his replies and therefore he would keep copies of his answers, usually dictated to Miss Dukas, in the files. Only to very close people would he write by hand, and of these letters, too, Miss Dukas would occasionally then prepare typewritten copies for the records.

For his birthday letters came from all parts of the world, from royalty, academies, statesmen, scientists, the clergy, the military, artists, housewives, students and schoolchildren.

With a short note I sent him my *Ages in Chaos*, which he had not seen (it was published three years earlier) and Elisheva added that year a kiln-burnt ashtray which Margot chose for him out of several, just the littlest present, a thing hardly worth thanking for.

Many letters had Miss Dukas to write to royalty, to statesmen, and to the rest in reply to their good wishes, and she typed them. Einstein hardly wrote even a few of the acknowledgements by his own hand: it would have been an insurmountable task.

Three days after his birthday he wrote by hand one of his last letters, the last to me, or to us, since it was addressed to my wife and myself. He referred to his birthday as “unpropitious,” and how right he was. It was his last. “Soon the Devil will take me,” he once said to me; but deep down he was a religious man and in these words there was as if a confession of man’s sinful nature, in his calling Death by the name of the Devil. Although he was referring to the birthday as unproptious, he had many plans and much work to do—the low round table in his study often had papers with calculations by his hand, and his great and protracted effort to solve the problem of the unified field theory was still evading final solution.

The following translation into English is as close as the idioms of the two languages permit. He used “corns” for toes.

17.III.55

Dear Mr. and dear Mrs Velikovsky!

At the occasion of this unpropitious birthday you have presented me once more with the fruits of an almost eruptive productivity. I look forward with pleasure to reading the historical book that does not bring into danger the toes of my guild. How it stands with the toes of the other faculty, I do not know as yet. I think of the touching prayer: "Holy St. Florian, spare my house, put fire to others!"

I have already carefully read the first volume of the memoirs to "Worlds in Collision," and have supplied it with a few marginal notes in pencil that can be easily erased. I admire your dramatic talent and also the art and strightforwardness of Thackrey who has compelled the roaring astronomical lion to pull in a little his royal tail without showing enough respect for the truth. I would be happy if you, too, could enjoy the whole episode from its funny side.

Unimaginable letter debts and unread manuscripts that were sent in force me to be brief. Thanks to both of you and friendly wishes,

Your,

A. Einstein

This letter, for the brevity of which he asked consideration, was written four weeks before his death. By then he had read for the third time my *Worlds in Collision*, and was looking forward with anticipation to reading my historical work, *Ages in Chaos*. His saying that he would enjoy the embarrassment to which my work would probably subject the historians while his own field would be left untrespassed, speaks for the difficulties he had lately experienced and for the thoughts during his waking hours in the dark of the night—his sleep was not good—provoked by our discussions in which I acted as if I were the advocate retained by two natural forces, electricity and magnetism, persistent in my calls and letters, unyielding, never retreating.

“I Would Have Written to You”

From Einstein’s letter I learned that he had read my *Stargazers and Gravediggers.* Actually I had not intended to show it to him: as already said, on one of those two evenings in March when we read line by line my “"On the Four Systems of the World,” and Miss Dukas was present, I gave her the first file of those memoirs to read in order to keep her awake. But Einstein read it as well; in the first file the story is brought up to the time just before my parting with Macmillan.

A year earlier, upon reading the exchange of letters between Shapley and the Macmillan Company, Einstein said that the material must be made public but that somebody with dramatic talent should be entrusted with the presentation of the story; now, upon reading the manuscript, he obviously found that I had succeeded in the task.

The first folder of the “Memoirs” was returned to me—several of its sections were supplied with marginal notes by a pencil, not a sharp pencil to boot. On the back of one of the pages with the story of Larrabee’s article in *Harper’s,* Einstein wrote:

> Ich hätte Ihnen geschrieben: Die historische Argumente für gewaltsame Vorgänge an der Erdkruste sind recht überzeugend. Der Erklärungsversuch aber is abenteuerlich und sollte nur als *tentativ* behandelt werden. Sonst verliert der wohlorientierte Leser auch das Vertrauen in das solid Begrundete.

Translation:

> I would have written to you: The historical arguments for violent events in the crust of the earth are quite convincing. The attempt to explain them is, however, adventurous and should have been offered only as *tentative.* Otherwise the well-oriented reader loses confidence also in what is solidly established by you.

If one should compare this evaluation with his own of 1946 *("Blamage”)* or of 1950 or of 1952 or even of 1954, one must recognize how much Einstein’s attitude had changed. He did not protest any more or argue against the events described, neither against the earth being disturbed in its rotation, nor against the role ascribed to

Venus; even more remarkable was the fact that he no longer rejected outright the role of electromagnetism in the events and thus, in the celestial sphere in general: he would only have wished that I should not express myself with such finality. By this he made it clear that the explanation which I gave to the events was not undiscussable—but only that I should have offered it merely as a hypothesis.

Strangely, one of Einstein's marginal notes to my chapter on Lafleur agreed with the latter's argument that the Earth is neutral because of the behavior of the leaves of an electroscope touching the ground—they do not diverge. To me it was clear that the behavior of the leaves does not give an answer to the question whether or not the Earth is charged. The Earth being charged in relation to the upper atmosphere, the lines of force would pass in near-parallels vertically and, consequently, there would be no divergence of the leaves of the electroscope. Nikola Tesla was a great inventor, perhaps the greatest electrical engineer who ever lived; he would not have asserted that the Earth is a highly charged body if such a simple test with an electroscope could solve the problem. Actually, there is a permanent stream of electrons flowing from the ground upwards: it is calculated that between the feet and the head of a standing man of medium height there is a 150 volt potential. The source of this stream of electrons, or of the source of replenishment of the permanent discharge of the Earth, is not known.

The question of whether the bodies of the solar system are charged or not was from the beginning *the* question between Einstein and myself; as he acknowledged in a marginal note to my letter of June 16, 1954, this contention of mine was the main reason for the display of indignation against myself and my work. On that page of the letter, as the reader will remember, I offered a test to find whether or not the planetary bodies are neutral. At that time, in the summer of 1954, Einstein did not undertake anything in answer to my challenge and request; my offer to stake our debate on whether Jupiter is a source of radio waves, he dismissed in his marginal note, and I could not ask for the test again—it was the time when Einstein became sick, the sickness having kept him weak through the entire fall. But when we parted close to midnight on March 11, after having spent two long sessions at a week interval reading my essay, he said those words about the ability of a theory to predict and see its prediction fulfilled.

Jove’s Thunderbolts

In the spring of 1955 Providence wished that the drama should heighten itself. The old chief of all the pagans, the planet Jupiter, was destined to enter the scene and speak.

It was a spring day in early April in Princeton. This is the time of year when magnolia flower, and the Princeton campus has not a few of these trees, especially near the Firestone Library, profusely blooming. During the first week of April of that year the semi-annual meeting of the American Astronomical Society convened for three days in Princeton, in the University’s Chemical Building (Frick Laboratories). I entered the auditorium during the reading of one of the papers, when the audience was already seated, and chose a place on one of the back benches, close to the entrance. I did not wish to disturb the convention by my presence because, being recognized, I would have caused some discomfort. After listening to Dr. W. Baade and possibly to one more speaker, I left as quietly as I entered—I did not return for other papers. The program of the three-day convention had one hundred and two papers presented by astronomers from all over the country, but only one—not scheduled, yet read because of the great impact it carried in the field of planetary astronomy—made news. The next day, April 6th, opening the *New York Times,* I found a page-length column on a sensational discovery reported at the meeting. The column read in parts:

> Radio waves from the giant planet Jupiter have been detected by astronomers at the Carnegie Institution in Washington.
>
> The waves appear to be short bursts of static, much like those produced by thunderstorms on conventional radio receivers . . . no radio sounds from planets in our solar system have been reported previously . . . the existence of the mysterious Jovian waves was disclosed by Dr. Bernard F. Burke and Dr. Kenneth L. Franklin in a report today at a meeting of the American Astronomical Society here . . .
>
> The two scientists said that they did not have an explanation for the observed emission.
>
> — Princeton, N.J., April 6

The discovery was made entirely by chance when the Carnegie Institution astronomers scanned the sky for radio noises from far-away galaxies. In the news release it was told that Burke and Franklin, who detected the radio noises of Jupiter, were entirely unprepared to observe any radio signal from the planet; later their perplexity was more fully described: at one point they even assumed that some revellers returning from a party were the cause, trying to start the engine of their car, or that the radio noises were caused by some experiments on a neighboring radio station. But the noises were finally traced to Jupiter: in the weeks that followed, Burke and Franklin observed that the signals were arriving four minutes earlier each day and at length they realized that they must be of extraterrestrial origin. Every third night, for six minutes, when the receiving antenna was directed toward the spot crossed at these minutes by Jupiter, the signals repeated themselves. Then the astronomers of Washington came to the correct conclusion, unexpected and surprising as it was.

For me, this news had a special significance. My own earlier expectation of the noises of Jupiter was based on my view of the giant planet as the center of a powerful electromagnetic system. In ancient sources the planet Jupiter was associated with thunderbolts.

Before World War II, a discovery was made by Jansky of the Bell Laboratories that radio signals arrive from the Milky Way. During the War it was discovered by the U. S. Army Signal Corps in Belmar, New Jersey, that the sun sends out radio noises, too: it was a chance discovery made in the process of testing radar echoes from the moon. Then radio noises were found arriving from far-away galaxies and were explained as crashes between galaxies riding through one another. A new science—radioastronomy—was born.

My understanding of the nature of the sun and planets made me assume that these bodies are charged, or that at least their atmospheres are strongly ionized. Of Jupiter and Saturn it is known that they influence in some mysterious manner the solar spot activity: but nobody thought that these bodies or their atmospheres are charged.

Now, seeing my claims confirmed, I called Helen Dukas and told her that I would like to acquaint Professor Einstein with the discovery of the noises coming from Jupiter, and wished to see him, for a few minutes only—we agreed that I should come Friday, April 8th, in the afternoon. Then I called my editor at Doubleday, Walter Bradbury, and told him that I would come the next day, in the morning. Already on the phone I drew his attention to the column in the *Times.* My book, *Earth in Upheaval* was being prepared for print, together with my lecture before the Forum of October 14, 1953 as a supplement,[1] and this lecture contained my challenge that Jupiter would radiate radio signals. For several years I wished that a check should be

made on Jupiter, and took this opportunity to suggest it to scientists. In my letter to Einstein of June 16, 1954 I again suggested that an investigation be performed—it was a challenge on my part to Einstein to stake the debate on this my claim and at the same time a plea to help me that the test should be performed. Einstein did not respond in that instance. In a note made on the margin of my letter he wrote that this would be no criterion. This was not well thought through. Either there must be on Jupiter a dissociation of negative and positive charges that would produce thunderstorms of unearthly magnitudes, or, more likely, the entire body of Jupiter is charged, surrounded by an electromagnetic field, and attracts opposite charges from space, yet by continuous subatomic processes of fission in the great discharges, or by some other process, keeps its general charge undiminished.

The Forum lecture, a discussion of my theses of 1950 in the light of new discoveries in the fields of archaeology, geology, and astronomy, brought in its wake, even sooner than I dared to hope, a confirmation of a bold yet well-founded advance claim. the discovery of the Jupiter noises thrilled me as had no other confirmation before, and it was the first of a long and spectacular series.

References

1. The text was already copy-edited the summer before by Mrs. Kathryn Tebbel, a copy-editor at Doubleday, and the passage carries her pencil marks with two minor stylistic corrections. Thus Doubleday could witness that my lecture about Jupiter was in their hands long before the discovery was made.

“A Near Miss”

On April 8th I saw Walter Bradbury, the managing director of Doubleday, and my editor. He offered to write to the astronomers in Washington—though I told him not to expect anything favorable for me in their response. The same day he wrote this letter:

April 7, 1955

[read April 8, 1955]

Dr. Bernard F. Burke
Dr. Kenneth L. Franklin
Dept. of Terrestrial Magnetism
Carnegie Institution
Washington, D.C.

Dear Drs. Burke and Franklin:

We note the New York Times article of Wednesday, April 6 describing your detection of radio waves from the planet Jupiter.

In this connection I would like to bring to your attention the following passage:

“In Jupiter and its moons we have a system not unlike the solar family. The planet is cold, yet its gases are in motion. It appears probable to me that it sends out radio noises like the sun and the stars. I suggest that this be investigated.”

This passage appears in the manuscript of a book entitled *Earth in Upheaval* by Dr. Immanuel Velikovsky. This passage occurs in a supplement to Dr. Velikovsky’s manuscript which comprises an address given on the Princeton University campus, Forum of the Graduate Students in October 1953. The manuscript including this passage has been in our possession since last Spring and this particular paragraph was edited in our offices in the summer of 1954 by Mrs.

Kathryn Tebbel, our copyeditor.

I understand that it was surprising for an astronomer to find these strong discharges on a planet. I would like to suggest that you might be interested in discussing with Dr. Velikovsky the theory behind his statement in the quoted passage. In any case I would appreciate your reaction to the fact of Dr. Velikovsky's prediction of what you have subsequently discovered.

Yours sincerely,

Walter I. Bradbury
Managing Editor

The answer, signed by Bernard F. Burke and Kenneth L. Franklin, was written on April 12, 1955, and in order not to return to this issue for a while, I give already here the answer:

Mr. Walter I. Bradbury
Doubleday and Co., Inc.
575 Madison Avenue
New York 22, New York

Dear Mr. Bradbury:

Your letter of April 7, 1955, referring to our recent radio work has been received.

In his previous work Dr. Velikovsky has shown a willingness to make frequent speculations on the vaguest (and frequently incorrect) physical grounds. It is not surprising that an occasional near miss should be found in the large number of wild speculations that Dr. Velikovsky has produced, but such a coincidence could never be regarded as a true prediction.

We do not feel anything would be gained from a meeting with Dr. Velikovsky.

Sincerely,

Bernard F. Burke
Kenneth L. Franklin

The Last Meeting

After seeing Bradbury I took the train back to Princeton, and had very little time before my appointment to see Einstein. This time it had been Elisheva who asked me to do something about the fulfillment of my prognosis, and to see Einstein: this was very unusual on her part. It turned out to be my last meeting with him. Elisheva thought to remain in the car because I was dropping in for a few minutes only, but I asked her to enter with me, as at all previous occasions. She would have regretted it later if she had not been present at this meeting, the last, after having attended all our long conversations since November 1953. It was four in the afternoon when we arrived at Einstein's house.

As in all our conversations since the the previous summer, Einstein received us in his study on the second floor. As usual we found him standing in front of his chair to greet his visitors on entering the room. We sat in chairs, the low round table before us. On the table were pages with figures and calculations that Einstein was working on. He sat on my left, close by.

I could not keep to my intention of spending only a few minutes with him because he started on a different subject:

"I have carefully read your memoirs to *Worlds in Collision*, the first two files in their entirety, and most of the third file. It is very well written. But you should shorten it and omit some parts that do not sound proper. The book must be a collection of documents."

"Give me an example of things to omit."

"The section about scientists as priests—it is impossible to read it."

This section, called "Nearer the Gods no Mortal May Approach," was a biting satire on the astronomers, who have taken over the role of ancient priests in society; they were assured by Halley:

> But now, behold,
> Admitted to the banquets of the gods,
> We contemplate the polities of heaven;

And spelling out the secrets of the earth,
Discern the changeless order of the world
And all the aeons of its history.

Of Newton, Halley said: “Nearer the gods no mortal may approach.” In this early version of the essay I finished this satire with a sentence from Charles Fort: “The astronomers explained. I don’t know what the mind of an astronomer looks like, but I think of a fizzle with excuses revolving around it.”

I accepted Einstein’s criticism without discussing it, and only asked whether he had read the section about himself, “Before the Chair of Jupiter.” He said that he had read it, and smiled approvingly; obviously he liked it.

We did not yet discuss Jupiter; I was precluded from touching the subject by his announcement:

“I have again read in *Worlds in Collision.* It is a book of immeasurable importance, and scientists should read it.” These words, to hear them—had I not come a long way? “But why do you need to change the theory of evolution and the accepted celestial mechanics?” Einstein continued—and the crest inside me started to fall. I was under the impression after our two night sessions in March that I had finally planted a seed of doubt in the accepted scheme, and I expected that this seed would grow in size, not shrink. But saying this, Einstein was again as if retreating to a system of material bodies with no electrical or magnetic interplay between them.

“I could explain everything you describe in your book on the basis of the accepted celestial mechanics of gravitation and inertia.”

“Even the circular orbit of Venus?” I asked.

“Even the circular orbit of Venus,” he answered, “though this would require a very unusual degree of coincidences.”

I admit—I was not equal to the task. Most probably the rush in the morning to New York and then back to Princeton drained me of my usual control—because at all our meetings I was very conscious of every word I said and turn I made. Here, instead of asking him to explain how would he, in theory, be able to make the orbit of Venus almost circular, I permitted myself to slip into a side track: instead of pressing him to tell me his treatment of the facts described in my book concerning celestial mechanics, I sidestepped to answer that part of his challenge that referred to Darwin. It can be understood, because there I knew more than Einstein, and I could elaborate on my opposition to the dogma of uniformity—the discourse of the concluding

chapters of *Earth in Upheaval.* And, of course, I could not know that this was our last meeting.

Sometime during this visit I took out my letter to him with his marginal note concerning Jupiter, reminded him very shortly what had been discussed between us ten months earlier, and then read a few sentences from the *New York Times* of the day before about Jupiter. By now he was sitting to my right, facing me. He became obviously very much taken by what he learned, and the next question he asked was this: "But how did you come to this conclusion?"

Should I have gone once more through all the gamut, played already more than once, and claimed the charged state of Jupiter—because if the solar system is charged, Jupiter would be the focus of much of that charge? Did not also the ancients, from one end of the world to the other, speak of Jupiter's thunderbolts by which the "three-fold mountain masses fell"? Why did the ancients pray to this planet and sacrifice to it? Or why are Jupiter and Saturn in some way connected with the sun spot periods? By gravitation alone they could not produce such an influence.[1]

Or why does the perturbation activity between Jupiter and Saturn suffer changes (between the minimum of the year 1898-1899 and the maximum of 1916-1917 there was found an 18 percent difference).[2]

And did I not apply the name "a dark star" to Jupiter in the Epilogue to *Worlds in Collision?* Charged and swiftly rotating, it must create an extended and rotating magnetic field in which its charged satellites move. . . Yet I hardly mentioned these things.

But he was embarrassed. Had he not told me when parting after our last meeting in March about the great importance for the acceptance of a theory that it be able to generate accurate predictions? This was on March 11th. Now, four weeks later, I brought him the message that the very probe that I offered as a crucial test between our stands came out in my favor. Now he inquired what my reasons had been. It was not easy to answer his question, because Einstein became very emphatic. He stood up. His face was glowing. He spoke loudly, in a way I had never heard him speak before. "Which experiment would you like to have performed now?" he asked, in obvious desire to mitigate his guilt, because the previous summer he had not given enough attention to my request, and he let my suggestion go without action on his part.

More than once Einstein had asked me to disregard the attitude of my opponents, to enjoy the solitary way, to take an example from him. Now he felt that he had failed me—the test was not made, whether to prove me right or wrong. He answered his

own question: “I know which experiment you would like now—the Cavendish experiment in a Faraday Cage.” This was mentioned in my paper we read in March, and he remembered it—I also proposed it in my June, 1954 letter, right after proposing the Jupiter test.

“No,” I said. “I prefer you help me now to have a radiocarbon test for my historical work performed.” And I explained in a few sentences what this test is about. He was more than willing to help. “This will be done,” he spoke loudly and gesticulated, and repeated again, “This will certainly by done.” He was still standing in his excitement. He asked details of what he should do. I told him that I would like him to write to Dr. W. C. Hayes of the Metropolitan Museum of Art. He again asked me to let him know what exactly he should request and I promised to prepare a short draft in a few days.

But soon he sat again close to me, almost touching my left arm, and listened to me, and peace descended on him; his long hair hung framing his face, his eyes were looking across the room through the picture window toward the upper branches of the big trees in the back yard, and the expanse of the sky.

“Oh, look. Please look,” he cried out and grasped my hand, “the birds are flying in big flocks.”

Hundreds of birds in a fluttering swarm flew at a distance, all in one direction, and the swarm moved in a wave-like motion down and up as they hurried by. I looked for a few moments at the flying birds, and then continued my words. But soon again Einstein, enchanted, looked at another swarm of birds returning from their winter quarters in the south, and again could not resist calling my attention to them. He followed their flight with longing, and his face shone with sweet sadness. It was already the hour of twilight, the trees stood silent outside, still leafless, the branches hardly moving in the stillness of the clear and balmy hour.

We spent over two hours together, a little less than at our other meetings, but certainly longer than the “few minutes” intended.

References

1. Fox of Vancouver, Canada, found that the influence of Mars on the solar sunspot cycle exceeds by twenty-five times the influence it would be expected to have on the basis of gravitation alone. (AAAS Convention, Feb. 25, 1974, Evening Session).
2. J. Zenneck, “Gravitation” in *Encyclop. der Mathem. Wiss.*, vol V. pt. I, p. 44.

The Last Week

When I returned home I did what I had never before felt the need to do. Thinking of that part of our conversation where Eintein announced that he could explain all the phenomena described in my book without recourse to electromagnetic interplays, and realizing that I should have stuck to this subject during our conversation, I wrote down how the dialogue went and how it should have gone.

It took me a full week to prepare the few details for Einstein so that he could write to Dr. W. C. Hayes of the Metropolitan Museum concerning the desired radiocarbon tests—but the real cause of my procrastination was my desire to answer Einstein on two points of our debate. Is it possible to measure the charge of the Earth with an electroscope? Is it feasible that the sun may be charged? One of my critics, Laurence Lafleur, of whom Einstein read in File II of *Stargazers and Gravediggers*, asserted in *Scientific Monthly* in an article directed against me that if the Earth were charged, an electroscope would show this. Surprisingly, Einstein thought, too, that an electroscope would reveal whether the terrestrial globe were charged: since the foils are not repelled from one other when an electroscope touches the ground, the globe must be neutral. In the beginning of the week, actually on Tuesday, the 12th of April, I traveled to New York and conferred with Lloyd Motz at Columbia University, on the upper floor of the Michael Puppin Building, as I had done so many times before. He agreed with me that an electroscope would not disclose a charge of the ground. I, of course, counted on the probability that the charge of the Earth as a planet is concentrated on the periphery—the charge of a conducting object is usually spread on the surface—and that either the ionosphere is charged, or that above the ionosphere there are layers of greater intensity of charge.

I invited Dr. Cunningham, a young physicist, then on the staff of the Forrestal Center near Princeton, to spend an evening with me. We discussed the same question: whether one can prove with the help of an electroscope—two golden foils at the end of a rod, inside a jar—that the Earth is neutral. Parallel streams of particles moving not only through the foils but also around and alongside them would keep the foils together; thus an electroscope would not reveal whether the ground—and hence the globe in its entirety—is neutral. Dr. Cunningham agreed with me and explained in greater detail why this is so.

Next we discussed the charge on the sun, and Dr. Cunningham maintained that the sun not only can be charged positively, but that it must be charged so, and this due to

the circumstance that electrons have a much greater mobility than the protons, and thus many more electrons must have left the sun before the relatively slow-moving protons could do the same, and the protons thus left behind would be responsible for the positive charge of the sun. Thereafter positive and negative particles would leave the sun in equal numbers, but the original surplus of positive particles would permanently keep the sun positively charged. Thus in theory the sun not only can be charged, but must be so.

I, however, considered the whole solar system as a unit and a surplus of one sign charge on the sun would be neutralized by a surplus of the other sign charge on the planets, especially the larger planets, primarily Jupiter.

During that week I went also a few times to New York to work with Mrs. Kathryn Tebbel on the manuscript of *Earth in Upheaval*, which she was in the process of copyediting. This absorbed the week. By Friday, April 15th, I had prepared the necessary explanation of what should be asked from Dr. Hayes of the Metropolitan Museum of Art, and had also put into writing my answer to the two problems Einstein and I had discussed: the measurement of the Earth's charge by an electroscope, and whether the sun carries a positive charge.

In addition I answered in some detail Einstein's question about the basis for my prediction of the radionoises from Jupiter. Finally, I enclosed a clipping from a *New York Times* article of April 12, 1955 about magnetic stars. It read as follows:

STARS CALLED FLATTENED BY ASTRAL MAGNETISM

> Chicago, April 11 (UP)—Magnetism is so strong on some stars that they are flattened and look like "flying saucers," a scientist said today.
>
> In fact, he said, there is evidence that cosmic rays, accelerated to terrific speeds by the magnetic fields of the Milky Way, may drain off completely these energy fields in "a hundred million years or so."
>
> The role of magnetism in the universe was described by Subrahmayan Chandrasekhar, Professor of Astrophysics at the University of Chicago. He reported on studies made by himself and the late atomic physicist, Enrico Fermi.

A few notes about our last conversation on April 8th, 1955

1. The difference in voltage—100 volts for 1 meter altitude near the ground—indicates that the Earth is charged by 450,000 coulombs,

which is very little for the globe of this size. (It is calculated that the Earth must lose its charge in 8 minutes, but some unidentified mechanism replenishes the charge).

But is it correct that if there is an electric layer far above the ground, the above measurement and calculation do *not* reveal the overall charge of the Earth, which may be large?

2. A physicist at the Forrestal Center (Dr. Cunningham) expressed to me his opinion that the Sun not only can be charged but must be charged—positively—because the electrons easier surmounted the required velocity of escape from the sun than the protons; the equilibrium (balance) in escape of positive and negative ions was established after the sun was charged positively. Is it so?

3. Enclosed is a clipping from NYTimes, April 12th, concerning an opinion expressed by Chandrasekhar of the University of Chicago on magnetic stars.

4. My Jupiter prediction. In my letter to you of June 16, 1954, on which I worked for several weeks, I included my request to help me with the performance of two tests: “Does Jupiter send radio-noises or not? This can easily be found, if you should wish.” And “It should be easy to find out the [gravitational] constant in a cage. But not easy for me. Especially since Shapley in a relentless effort made me ‘out of bounds’ for scientists.” You found the tests unnecessary because no revealing results would be discovered.

Before writing to you, I wrote in my lecture at the Forum of the Graduate College: “In Jupiter with its moons we have a system not unlike the solar family. The planet is cold, yet its gases are in motion. It appears probable to me that it sends out radio noises like the sun and the stars. I suggest that this be investigated.” A copy of my address was read by you, and another copy with that prediction is still, now over a year, in the hands of Professor Bargmann.

A few weeks ago very violent noises were discovered coming from Jupiter, to the general surprise of the discoverers and astronomers in general. Now you say that I have not given an adequate substantiation of my prediction and therefore the revealed results do not support me. Only shortly before you said that a predicted discovery carries great weight.

> Knowing from the ancient literature of the behavior of Jupiter and realizing its part in the great perturbations of the early historical past, I made my prediction. From the ancient traditions of many peoples of the world, I learned about violent discharges between Jupiter and bodies that passed close by. I concluded also that the connection between Jupiter and the solar spots cannot be purely gravitational; I assumed the charged state of Jupiter; in such case Jupiter would attract to itself charges of opposite sign and cause radio noises; or, if Jupiter is neutral, charges separated in Jupiter's atmosphere would cause strong discharges; such discharges, if directed to passing bodies, would have been the thunderbolts of Jupiter. Phaethon that caused the conflagration of the world by turning the solar chariot from its charted path, was struck by the thunderbolt of Jupiter and was changed into the Morning Star (Hyginus). Seneca distinguished lightnings that "seek houses" or "lesser bolts" and the bolts of Jupiter "by which the threefold mass of mountains fell" *(Worlds in Coll.*, p. 272, German edition p. 288). Much more on this subject will be in my story of earlier catastrophes, Deluge, Sodom and Gomorrah. Sulphur falling from the sky was, in my opinion, the result of nuclear fusion of two atoms of oxygen, at interplanetary discharges (On brimstone and fire from heaven—Genesis 19:24 and many other sources), or at least discharges between an overcharged ionosphere and the ground. In my letter to you I have not given the extensive literature to support my claim.
>
> Whether my ground was firm or weak, now that my prediction is fulfilled, should we follow the evangelical rule (Matthew 13:12):
>
> "For whosoever hath, to him shall be given, and he shall have abundance: but whosoever hath not, from him shall be taken away even that which he hath."

On Friday, April 15th, armed with these materials, I telephoned Einstein's home. I wished to see him. Miss Dukas as usual answered the telephone. "How is Professor? I prepared . . ."

But Miss Dukas answered in a sad voice: "Oh, dear Doctor, we are awaiting the ambulance to take Professor to the hospital. In less than an hour the ambulance must arrive. Since Wednesday he has felt very strong pains. Dr. Dean says it is of gall bladder that is very hot and painful." My heart sank.

Einstein could suffer pain without complaining. He would not have agreed to go to a hospital were there not a great need for that. Miss Dukas sounded very worried. I

asked her to call me the next day, and to tell of Einstein's state of health. The next day, Saturday, I had a worried call from Dukas. She was alarmed. Einstein awaited his son from California. But the world, the town, and even close acquaintances were kept ignorant of Einstein's sickness and the fact that he had been hospitalized. I kept the secret too.

The day thereafter, on Sunday, Dukas called and said: "It is better, definitely better. His son arrived from California. He wished to have him here." Einstein's physician wished to perform surgery—as I understood for gall bladder—but the Professor refused—with humor, but firmly; he said that he did not wish to be cut. A little reassured, but not in full measure, I spoke a sentence or two of our meeting nine days earlier and repeated Einstein's words about my book. It was an achievement of eighteen months of struggle; probably I should not have at that hour thought about my work and about what Einstein said at our last meeting. but it was as if I wished to be near him and talk to him again; I felt gratitude to him, the great scientist who through months of sickness occupied himself with my ideas and read my manuscripts and books at a time when the scientific world with its press was cruel to me.

Sunday passed—I do not remember whether we had another call from Dukas or not. It would not have been proper to call the hospital.

The following night I slept peacefully and, if I remember right, Elisheva and I both dreamt of Einstein. At eight in the morning I went to our garden, where the forsythia were already in bloom. I met Mrs. Baker, the neighbor, who said: "Have you heard on the radio? Dr. Einstein died this night."

In silence I moved away and said the Hebrew prayer for the dead that is supposed to be said by a son after his father's or mother's death, in a congregation of not less than ten men, but that after the death of my mother I would often say walking along a road on the ridge of Mt. Carmel. The last sentence of it reads: "He who established peace in the sky will bring peace to you and the entire Israel!" The words "peace in the sky" or "peace on high" have a meaning in the light of events illuminated in my *Worlds in Collision*, and I think the rabbis who composed the prayer in ancient times had those events in mind. Einstein became a paternal figure to me, and though our meetings took place only once in a while, during these eighteen months we were often in each other's thoughts.

The morning newspapers had no word about Einstein; his sickness, his being in the hospital, were known only to a few people, besides the personnel of the hospital, and did not leak to the press; therefore when he died in the night from Sunday to Monday, the *New York Times* and other always well-informed papers appeared with nothing even remotely foreboding the death of the most famous man on earth.

I went to the hospital. On the way I met Dr. Irving Levey, the Jewish chaplain of the University, on a bicycle—already on his way back from the hospital. We hardly exchanged a few words—there was nothing to say.

The begrudging press, which learned the sad news from the radio after an announcement by the hospital, hurriedly sent their correspondents, who tried to pry something out of anybody entering. Margot Einstein was sick in bed in the same hospital and in her room the "inner circle" gathered—only five or six persons. At first I was not admitted—to the inner circle I did not belong. Dr. V. Bargmann, physicist and close collaborator of Einstein arrived simultaneously with me and went up. Leaving the building I was met in the courtyard by Mrs. Ladenburg, the widow of a physicist and a close friend of the family, and she insisted on my going with her to Margot's room. I was too passive to resist.

In her room I saw for the first time Hans Einstein, the son, professor of agricultural engineering in California; he looked handsome and unexpectedly young. The few who were in the room stood at the wall next to the window, but in shade. Margot, always very kind to me, stretched her hands to me from her bed. I said nothing. Dukas came close to me from the row of the standing figures with dimly lit faces along the wall and spoke to me softly and quickly, narrating how everything happened; I listened but do not know what I heard. I brushed a tear from my eye and without having said a single word left the room. In the hall again a newspaperman started to question me. I advised him to clear his story with Helen Dukas at a later time.

At the time I was in the hospital, only a few hours after Einstein's death, the autopsy was being performed; it was found that Einstein had died of a bleeding aorta, a painful process that, as I learned later, was already chronic with him. And his brain, still warm, was being taken from the opened skull by Dr. Thomas Harvey, the hospital's pathologist, a pleasant and thinking man, shy too; but how could he drill into Einstein's head and pry open his skull? I had the feeling that all was done in a hurry. It seemed to me almost as if the brain still had its molecules moving in a thinking or feeling process. Dazed, I hurried from the hospital and went home.

Einstein ordered in his will that his body should be cremated, and only his brain should be used for scientific purposes. His body was cremated not far from the city borough that very day, so that when the next day's papers printed their story, they had to tell in one single issue of his disease, death, and cremation.

I did not feel like going to the library or working at my desk. I took the family (our daughter Ruth had moved recently from California with her husband) into the car, and drove for over an hour in a great circle on country roads around Princeton, past

blossoming orchards, with the sky wide open over the spring ground. At that very hour Einstein's ashes, atomized to elements, were being spread over the fields in the afternoon spring breeze. He was consumed by fire and his physical remains returned and mingled with the cosmos and became a part of it, inseparable and anonymous.

Nine days earlier we had brought close to conclusion a protracted debate. "I will not let thee go unless thou bless me." I thought of the words I once wrote to him. I thought also of the longing look with which he followed the birds flying in formation back from their winter quarters, before the dusk when we sat that last time in his study, facing the window. "Do you see the birds flying?" he asked me. But now in my memory it sounded as if he had said: "Let me go."

Gina Plungian who arrived the same day went with Helen Dukas to the study to find how everything had been left there the Friday before. On Einstein's table close to the window was *Worlds in Collision* in German, with many strips of paper between the pages, and open on some page. It was the last book that he read, actually re-read for the third time, each time differently impressed. I was also the last man with whom he discussed a scientific subject (besides a doctor friend from Switzerland, with whom, as I was told by Miss Dukas, about the time of my last visit he also discussed some scientific matter).

The subject we discussed was brought to the finale. Especially grateful I was for the two long evening sessions in March when we read line by line my short essay. Only then did he really understand my thoughts.

I never discussed with him the Theory of Relativity. But by implication it was involved in our debate and even very heavily.

Days passed. The town of Princeton was orphaned but went its normal way. I had the sensation as though I had lost my father for the second time. I could not know him as closely as some others knew him, like Miss Dukas, who was his secretary for twenty-six years. But there was some special bond forged, a kindness and an empathy—and now the link was torn and the town became empty for me. His associates took it much easier, or so it appeared to me. Several days later Margot lost her pet bird which she had taught to share with her hours of vigil and sleep and who ate from her lips, and she was grieving over the bird. Miss Dukas was lifted by the great responsibility that now fell on her, with the archive and manuscripts, and she was up to this, and soon she was even more resolute than ever.

In the daily press one could read that there was already strife over who, the Montefiore Hospital in New York, or the Princeton Hospital, should have the brain of the deceased for study. Later there was some compromise achieved. When years

afterward I asked Dr. Harvey, who sliced the brain, whether he found any unusual traits, he, in his shy and modest way, admitted that no unusual traits in form, volutions, or size were observed. If anywhere or anytime there was need to show how little we know of the human soul and its housing in matter, here was the case.

The Einstein-Velikovsky Correspondence

This correspondence is discussed in Velikovsky's book
Before the Day Breaks

Einstein to Velikovsky	July 8, 1946
Velikovsky to Einstein	July 16, 1946
Einstein to Velikovsky	January 5, 1951
Velikovsky to Einstein	August 26, 1952
Einstein to Velikovsky	August 27, 1952
Velikovsky to Einstein	September 10, 1952
Velikovsky to Einstein	January 6, 1954
Velikovsky to Einstein	May 21, 1954
Einstein to Velikovsky	May 22, 1954
Velikovsky to Einstein	June 16, 1954
Velikovsky to Einstein	September 17, 1954
Velikovsky to Einstein	January 11, 1955
Velikovsky to Einstein	February 2, 1955
Velikovsky to Einstein	March 7, 1955
Einstein to Velikovsky	March 17, 1955

July 8, 1946

Dr. Immanuel Velikovsky
526 West 113 Str.
New York City

Sehr geehrter Herr Velikovsky:

Ich habe dass ganze Buch betreffend den Planeten Venus durchgelesen. Es ist viel Interessantes in dem Buch, was beweist, dass in der Tat Katastrophen stattgefunden haben, die auf extra-terrestrale Ursachen zuruckgefuhrt werden mussen. Dagegen ist es fuer jeden vernunftigen Physiker evident, dass diese Katastrophen nichts zu tun haben konnen mit dem Planeten Venus, und dass auch die Rotationsrichtung der Erde gegenuber der Ecliptic keine erhebliche Anderung hat erfahren konnen, ohne dass die ganze Erdkruste vollig vernichtet worden ware. Ihre diesbezuglichen Argumente sind so schwach gegenuber den mechanisch-astronomischen, dass sie von keinem Fachmann ernstgenommen werden konnen. Das Beste ware nach meiner Meinung, wenn Sie Ihre Bucher, die wirklich wertvolles Material bringen, in diesem Sinne revidieren wurden. Wenn Sie sich dazu nicht entschliessen konnen, wird das Wertvolle an Ihren Uberlegungen nur unwirksam gemacht und es durfte sich schwerlich ein vernunftiger Verleger finden, der das Risiko einer so schweren Blamage auf sich nehmen wurde.

Ich teile Ihnen dies schriflich mit und sende Ihnen gleichzeitig Ihre Manuscripte zuruck, weil ich an den in Aussicht genommenen Tagen nich frei sein werde.

Mit freundlichen Grussen, auch an Ihre Frl. Tochter

Ihr

Albert Einstein

Translation:

July 8, 1946

Dear Mr. Velikovsky:

I have read the whole book about the planet Venus. There is much of interest in the book which proves that in fact catastrophes have taken place which must be attributed to extraterrestrial causes. However it is evident to every sensible physicist that these catastrophes can have nothing to do with the planet Venus and that also the direction of the inclination of the terrestrial axis towards the ecliptic could not have undergone a considerable change without the total destruction of the entire earth's crust. Your arguments in this regard are so weak as opposed to the mechanical-astronomical ones, that no expert will be able to take them seriously. It were best in my opinion if you would in this way revise your books, which contain truly valuable material. If you cannot decide on this, then what is valuable in your deliberations will become ineffective, and it may be difficult finding a sensible publisher who would take the risk of such a heavy fiasco upon himself.

I tell you this in writing and return to you your manuscript, since I will not be free on the considered days.

With friendly greetings, also to your daughter,

Your

Albert Einstein

July 16, 1946

Dear Professor Einstein:

I thought carefully of what you wrote in your letter of July 8, for which I thank you very much. I thank you also wholeheartedly for the time you gave me on July 5, and for reading a part of my Ms “Worlds in Collision.”

I was perfectly aware that my historical cosmology is in conflict with the accepted physical laws, and because of that I asked you to read it. You stress two instances. The reversal of rotation (not revolution) is attested not only in traditions but also in geo-physics: the magnetization of rocks “indicate that the polarity of the Earth has been completely reversed within recent geological times.” . . .

In the last part of my cosmology I try to solve the problem of the conflicting geological and historical data versus the accepted laws.

Best regards to Miss H. Dukas who received us with friendliness at your home.

Very truly yours,

Immanuel Velikovsky

den 5. Januar 1951

Dr. Immanuel Velikovsky
558 West 113th Str.
New York 25, N. Y.

Sehr geehrter Herr Velikovsky:

Ihr danke Ihnen sehr für die Zusendung Ihres Buches und auch für den alten Band unserer damaligen Publikation. Ich glaube Sie haben das Zeug dazu, auch das kleine Einmaleins mit historisch-philologischen Methoden grundlich zu widerlegen. Des Beifalls der Lainen, welche einen geheimen Grimm gegen die Rechnerei haben, können Sie sicher sein.

Freundlich grüsst Sie

Ihr

Albert Einstein

August 26, 1952

Dear Professor Einstein:

When, by chance, we met last week at the lake, I became aware that you are angry with me personally for my “Worlds in Collision.” From you I have not expected this reaction.

I have written a culture-historical book. A physicist cannot prescribe to an historian what he is allowed to find in the past, even if he finds contradiction between the alleged historical facts and our understanding of natural laws. There are facts a physicist observes daily which are in conflict with the laws he formulated; one such case is the keeping together of positive elements in the nucleus of an atom; he accepts the fact though it contradicts the law, and he looks for some explanation.

Two facts appeared to the scientists as fallacious in my book: 1. No forces in the celestial sphere but a head long collision could retard the earth in its rotation or incline its axis into a different astronomical position, and in such a collision our earth would have perished; 2. No planet could have come to its orbit as recently as a few thousand years ago, and therefore Venus could not have traveled on a cometary orbit in historical times.

These two assertions are true only if gravitation and inertia are responsible for planetary motions, a notion subscribed by every “vernünftigen Physiker.” Here, though no physicist or astronomer, I am provoked to disagree.

The sun has a general magnetic field, the solar spots are magnets, the solar prominences return on an oblique line to the place on the solar surface from where they erupted, the cometary tails are repelled by the sun in a manner and with velocities which the pressure of light cannot explain; the earth is a magnet; the ionosphere, the polar light, the ground currents, the terrestrial magnetism react to solar disturbances; cosmic rays are charges that travel in magnetic lines of force; meteorites come down in a magnetic state; the position of the moon

influences the radio reception (Stetson); the position of the planets influences the radio reception (Nelson of RCA); the fixed stars are strong magnets (Babcock). In the face of all this is it true or wrong to insist that only gravitation and inertia act in the celestial sphere? And if the electromagnetic fields are not invented by me for the solar system ad hoc in order to explain the phenomena and their interpretation as found in “Worlds in Collision,” then may I ask: Who is in conflict with observed facts, the astronomers that have all their calculations concerning the planetary motions perfect on the assumption that there are no electromagnetic fields in the solar system, or the author of “Worlds in Collision” ?

Venus could come to a circular orbit and the Earth could be retarded in its rotation or have its axis inclined, under the influence of electromagnetic fields. Such fields exist; at close distances they would act strongly. I believe, therefore, that not only the historical phenomena that I describe in my first book could have happened, but also that celestial mechanics that has all its motions explained without taking into account the electromagnetic fields in the solar system, is in conflict with facts.

I have read a book of a prominent astronomer of this city who says that nothing could take place in the celestial sphere which conflicts with the words of Jesus of Nazareth as preserved in the Gospels. Thus he has two world conceptions that live side by side in his mind—one of mathematics, the other of faith. But the rest of astronomers are like him: they acknowledge the magnetic and electrical properties of the sun and its spots, or of the fixed stars, of meteorites, of cosmic rays, occasionally also of cometary tails, and they do not deny that the Earth is a magnet, and that the sun, the moon, and the planets influence in some way the ionosphere; but as soon as it comes to the celestial motions, they still keep to pre-Faraday Laplace and Lagrange, and actually postulate sterile electricity and impotent magnetism, which do not act at distances, and which do no more than produce a Zeeman effect.

In my debate with Prof. J. Q. Stewart of Princeton Observatory in Harper’s Magazine, he presented the common view by asserting that electromagnetic forces have no part in the planetary relations. I, on the other hand, have written that the general solar magnetic field discovered by Hale (1912) was often denied to exist (Menzel). “Has not a basic mistake in observation or interpretation been committed?” Now this April, the same Menzel announces that the sun must have a

very strong magnetic field, and that there was a difficulty of finding it because of the angle of observation.

For over two years I have been a target of abuse and calumny. When did it happen that a spurious book caused such a fury in the minds of the contemporary scientists?

I have taken too much of your time. I wish you everything best.

Cordially,

Immanuel Velikovsky

A. Einstein
112 Mercer Street
Princeton
New Jersey, U.S.A

den 27. August 1952

Herrn
Dr. Immanuel Velikovsky
4 Hartley Avenue
Princeton, N.J. Sehr geehrter Herr Velikowsky:

Der Grund für die energische Ablehnung der von Ihnen vertretenen Meinungen liegt nicht in der *Annahme*, dass bei der Bewegung der Himmelskörper nur Gravitation und Tragkeit massgebend seien. Der Grund für die Ablehnung liegt vielmehr in der *Tatsache*, dass die zeitlichen Anderungen der Sternorter im Planetensystem sich auf Grund dieser Annahme mit einer unvorstellbar grossen Genauigkeit haben berechnen lassen.

Gegen solches präzises Wissen kommen Spekulationen von der Art, wie sie von Ihnen vorgebracht worden sind, für einen Sachkundigen nicht in Betracht. Deshalb muss Ihr Buch dem Fachmann als ein Versuch erscheinen, das Laien-Publikum irre zu fuhren. Ich muss bekennen, dass ich selber zuerst auch diesen Eindruck hatte. Erst nachtraglich wurde mir klar, dass absichtliche Irrefuhrung Ihnen ganz ferne lag.

Freundlich grüsst Sie

Ihr

Albert Einstein

Translation:

27th August, 1952

Dear Dr. Velikovsky:

The reason for the energetic rejection of the opinions presented by you lies not in the *assumption* that in the motion of the heavenly bodies only gravitation and inertia are the determining factors. The reason for the rejection lies rather in the *fact* that on the basis of this assumption it was possible to calculate the temporal changes of star locations in the planetary system with an unimaginably great precision.

Against such precise knowledge, speculations of the kind as were advanced by you do not come into consideration by an expert. Therefore your book must appear to an expert as an attempt to mislead the public. I must admit that I myself had at first this impression, too. Only afterwards it became clear to me that intentional misleading was entirely foreign to you.

With friendly greetings,

Yours,

Albert Einstein

September 10, 1952

Dear Professor Einstein:

By your answer to my letter you have truly obliged me to think the problem all over again. I have tarried to answer because I did not wish to appear just obstinate; but the problem is permanently on my mind. I have to ask patience, which a “Fachman” is generally reluctant to accord to an outsider. Without this patience we shall build barriers between sciences, in this case—astronomy and history. I would certainly listen carefully to what you may say on history or psycho- analysis.

You say that the *fact* of the exact correspondence of the planetary motions with the theory proves this theory as correct: in the celestial motions only two agents participate—gravitation and inertia. Let us first assume that your statement of exact correspondence between theory and phenomena is rigidly correct. Still the mere fact of a force acting at an inverse square rate would not exclude electricity and magnetism, also acting at the inverse square rate, from participation in celestial motions. But the statement is not rigidly correct, either. Let me illustrate.

Here is the year 1845. Leverrier in France and Adams in England, out of perturbations of Uranus calculated, to the exactness of one degree of arc, the presence of a yet unseen planet. Both of them assumed that a planet of a size not larger than that of Uranus travels on an orbit at a distance dictated by Bode’s law. Neptune is actually of the size of Uranus, but the mean distance between their orbits is not ca. 1,750,000,000 miles, as Bode’s law required, but only ca. 1,000,000,000 miles; thus the error is equal to ascribing to Neptune a triple mass. The discovery of Pluto did not solve the conflict between the theory and the fact and caused also conflicting estimates of Pluto’s mass. Thus the finding of the planetary stations in relation to a chart of fixed stars is not enough; if the theory is true the distances must also be correct. And still the discovery of Neptune is regarded as the strongest proof of the Newtonian theory of celestial motions.

Now in the same 1845, the year of this triumph, Leverrier calculated also the anomaly of Mercury, and by this caused to think that the Newtonian law of gravitation may be not precisely true. Leverrier first thought of some planet moving inside the Mercurial orbit or of a possible unequal distribution of the mass in the sun. You have used the fact of the anomaly to prove that the space is curving in the presence of a mass. About the same time—in 1913—G. E. Hale published his paper on “The general

magnetic field of the sun" (Contr. M. Wilson Obs., #71), in which he estimated the general magnetic field of the sun as of 50 Gauss intensity. At this intensity "under certain conditions electromagnetic forces are much stronger than gravitation." (Alfven) The last named author in his "cosmical Electro-dynamics" (Oxford, 1950, p. 2) shows that a hydrogen atom at the distance of the earth from the sun and moving with the earth's orbital velocity, if ionized, is acted upon by the solar magnetic field ten thousand times stronger than by the solar gravitational field.

Now the visible streamers of the sun that conveyed to Hale the idea that the sun is a magnet reach a long way toward Mercury, almost half the way. Was the electromagnetic state of the sun ever considered as the cause of the anomaly? The effect of the e.-m. action must have been reckoned, and possibly excluded, but not disregarded. . . .

The *fact* that the theory accurately coincided with the observed planetary positions was the main argument for the Ptolemaic system and against the heliocentric system. For more than two generations, until 1600, it was not the Roman Church who opposed the Copernican theory; the scientists opposed it and used as their main argument their ability to predict planetary positions, conjunctions and eclipses. They have actually predicted eclipses that we still have to experience in the future. How could they achieve this degree of accuracy with the sun revolving on one of the orbs around the earth? By a continuous adjustment of their observations to their theories and their theories to observations. Similarly it is today. And when the facts prove to be different from what they were supposed to be—that the sun is charged, or that the cometary tails are electrically glowing, or that planetary positions of Saturn or Jupiter markedly influence our ionosphere,—then these facts are left outside of the theory and it covers less and less of the phenomena. No wonder that it agrees with the residual facts in such an arrangement.

Sometimes it seems to me that the hidden psychological cause of the emotional attitude of the scientists to "Worlds in Collision" is in its reminding a few repressed physical facts. In that book I have not invented new physical laws or new cosmical forces, as cranks usually do; I have also not contradicted any physical law; I came into conflict with a mechanistic theory that completely coincides with a *selected* group of observations; my book is as strange as the fact that the Earth is a magnet, the cause of which is indeterminate and the consequences of which are not estimated in the Earth-Moon relations.

When over a year ago, Professor Stewart, your neighbor, was invited together with myself by the Presbyterian Society of this town to participate in a debate about my book, and the time became short, I asked my opponent: "But you have excluded the existing electromagnetic conditions in the solar system from the celestial mechanics," his answer was: "We do not need them: our calculations are perfect without them."

Later, when our debate was renewed on the pages of Harper's Magazine, I observed: "If the balance sheet of a bank is correct to the last cent, but two large deposits (electricity and magnetism) are omitted, the entire balance may be questioned." . . .

January 6, 1954

Dear Professor Einstein:

I have carefully put into writing my lecture before the Forum of the Graduate Students here (October 14, 1953). Doing so I was guided by the desire to place it before you for reading.

In the written form I have considerably shortened the archaeological and geological parts of my address; but I have elaborated on the astronomical part of it to a greater length than I did orally. Before submitting this paper to you I have asked Professor Lloyd Motz of the Astronomy Department of Columbia University to check its factual statements.

I am aware of the great demand on your time made by various authors; therefore have my sincerest thanks for agreeing to read this paper.

Cordially yours,

Immanuel Velikovsky

May 21, 1954

Dear Professor Einstein:

It may be that I said more than I was aright to say when yesterday evening I expressed myself that Einstein is humanly obliged not to be indifferent to the wrong that was and is still done by an organized group of scientists. But because of your position of a recognized leader among scientists and fighter for human rights, I feel obligated to you not to keep you uninformed.

These are two problems, entirely independent: Am I right in my theory? I am striving to prove it. Have I the right to express in writing the conclusions to which I came in an honest endeavor? Though the answer is elementary, this right was so mistreated that, following an attack this month, after some hesitation, I decided to ask more than just a few minutes of your most precious time.

With sincere regard,

Immanuel Velikovsky

22.V.54.

Dear Mr. Velikovsky!

Remarks on the part of your manuscript “poles displaced.”

The first impression is that the generations of scholars have a “bad memory.” Scientists generally have little historical sense, so that each single generation knows little of the struggles and inner difficulties of the former generation. Thus it happens that many ideas at different times are repeatedly conceived anew, without the initiator knowing that these subjects had been considered already before. In this sense I find your patience in examining the literature quite enlightening and valuable; it deserves the attentive consideration of researchers who according to their natural mentality live so much in the present that they are inclined to think of every idea that occurs to them, or their group, as new. *The* idea of a possible displacement of the poles as an explanation of the change of climate in any one point of the earth’s crust is a beautiful example. Even the idea of the possibility of a sliding of the rigid crust in relation to the plastic, or fluid deeper strata of the earth, was already considered by Lord Kelvin (and was in fact rejected).

The interpretation of the vote mentioned on pp. 159-160[1] as an attempt at a dogmatic fixation of the “truth” is not obvious to me. It is simply interesting for the participants of a congress to see how opinions concerning an interesting question are divided among those present. I don’t think that the underlying idea was that the outcome of the voting would somehow insure the objective correctness of the outcome of the vote.

From p. 182 on starts a wild robbers’ story (up to p. 189) which seems to rely more on a strong temperament than on organized considerations. Referring to p. 191: Blacket’s idea is untenable from a theoretical point of view. The remark about the strength of magnetization seems to be unjustified (p. 192); it could for example depend essentially upon the speed of cooling as well as on particle shape and size. The direction of the magnetic field during solidification must however quite certainly

determine the direction of magnetization. Bottom 192 etc.: wild fantasy! from here on marginal remarks with pencil in the manuscript.

The proof of “sudden” changes (p. 223 to the end) is quite convincing and meritorious. If you had done nothing else but to gather and present in a clear way this mass of evidence, you would have already a considerable merit. Unfortunately, this valuable accomplishment is impaired by the addition of a physical-astronomical theory to which every expert will react with a smile or with anger—according to his temperament; he notices that you know these things only from hearsay—and do not understand them in the real sense, also things that are elementary to him. He can easily come to the opinion that you yourself don’t believe it, and that you want only to mislead the public. I myself had originally thought that it could be so. This can *explain* Shapley’s behavior, but in no case *excuse* it. This is the intolerance and arrogance together with brutality which one often finds in successful people, but especially in successful Americans. The offence against truthfulness, to which you rightly called my attention, is generally human, and in my eyes, less important. One must however give him credit that in the political arena he conducted himself courageously and independently, and just about carried his hide to the marketplace.

Therefore it is more or less justified if we spread the mantle of Jewish neighborly love over him, difficult as it may be.

To the point, I can say in short: catastrophes *yes*, Venus *no*. Now I ask you: what do you mean when you request of me to do my duty in this case? It is not clear to me. Be quite frank and open towards me, this can only be good in every respect.

With cordial greetings to both of you,

Your

A. Einstein.

References

1. pp. 117-118 of the book

June 16, 1954

Dear Professor Einstein:

During the three weeks since I received your kind letter, I have composed in my mind many answers to you, and made a few drafts. I realized soon that I would be unable to compress all the problems into one letter and I decided to try to achieve with this writing only one step - to bring you closer to the insight that the global catastrophes of the past were caused not by a terrestrial but by an extra-terrestrial cause. Before discussing this, I would like to say that I am very conscious of the fact that you give me of the most precious in your possession - your time; and I would not have asked to pay attention to these matters if I did not believe that my material may, perchance, serve you too, whatever your conclusions should be. My delay in replying you is certainly not an act of lack of attention; just the opposite - not a quick reply, but a well thought through is a real courtesy.

You agree that (1) there were global catastrophes, and (2) that at least one of them occurred in the not too remote past. These conclusions will make you, too, to a heretic in the eyes of geologists and evolutionists.

Eight years ago, in 1946, under the impression of those chapters of Worlds in Collision that you have read then in manuscript, you have acceded in a letter that “in der Tat Katastrophen stattgefunden haben, die auf extra-terrestrale Ursachen zurückgeführt werden müssen.”[1]

Now, without re-examining the material that made you think so, you would like to retreat from this position. On the other hand, in 1946 you have brought two arguments against my theory, namely:

(1) “Dass diese Katastrophen nichts zu tun haben mit dem Planeten Venus.”[2]

(2) “Dass auch die Rotationstichtung der Erde gegenüber der Ecliptic keine erhebliche Aenderung hat erfahren können, ohne dass die ganze Erdkruste völlig vernichtet worden wäre.”[3]

It appears to me that today you keep no longer the second objection in that definite form; you presently assume that the terrestrial crust, rather catastrophically, moved over the interior of the earth; the experiences that the human kind must have had in such a plunge, would satisfactorily explain the phenomenon of the retreating sun (the cause of a great wrath in the days of Joshua and of Velikovsky as well), the change of cardinal points, of latitudes, of seasons and climate, and the inability of the ancient water- and sun-clocks to show correctly the time of today. It would, however, not explain the change in the number of days in the year, of which all ancient calendars (Maya, Inca, Hindu, China, Persia, Egypt, Babylonia, Assyria, Palestine, Greece, Rome) concur ("Worlds in Collision," pp. 312-359: these pages would certainly impress you).

Against a terrestrial cause of global catastrophes:

The surmise that an asymmetrical growth of polar ice caused in the past a sudden shifting of the terrestrial crust

(1) disregards all references in the folklore to the celestial phenomena accompanying the catastrophe: meteorites and "bursting of the sky," also darkness.

(2) disregards the geological find of unusual concentration of meteoric iron and nickel in the ocean bed (I attach a section of my new manuscript, "The floor of the seas," with a description of the work of M. Pettersson of Goeteborg Oceanic Institute).

(3) disregards the magnitude of the force necessary to move the terrestrial crust over the equatorial bulge. Ice covers of the polar regions are placed in the least favorable position to disrupt the balance. The seasonal migration of ice and snow from one hemisphere to the other never induced the slightest displacement of the poles. And finally, the most important counter-argument concerns the mass and the form of the terrestrial crust:

(4) "The data secured from observations . . . of the transmission of seismic waves indicate that the earth is either solid thoughout with the rigidity of steel, or that it is solid to a distance approximately 2000 miles below sea-level, with the solid portions having a rigidity greater than that of steel . . . This seems to indicate a contradiction between

isostasy and geophysical data." (W. Bowie, "Isostasy," in *Physics of the Earth*, II, 104).

The theory of isostasy was conceived in 1851 when J. H. Pratt found that the Himalayas do not deflect the plumb line as expected considering the mass of the mountains. It was assumed that the crust is thin and lighter than the magma and that every mountain has a mirror image protuberance immersed into the magma, thus the excess of the mass of the mountains is counterbalanced by a defect in the mass (difference between the lighter granite of the crust and the heavier magma). This, however, would signify that in order to move the crust over the very dense magma (twice the weight of granite) the isostatic protuberances (besides the equatorial bulge) will present obstacles that cannot be overcome by an asymmetric position of polar ice. If, moreover, the crust is 2000 miles thick, its mass represents a very substantial part of the globe.

What are the arguments against an extraterrestrial cause of the global catastrophes?

Arguments against extra-terrestrial agents are:

1. Ancient solar eclipses would not have taken place in appropriate times. Answer: As shown in my answer to Stewart, there is not a single case known where they actually did. By the way: the same argument, if true, would be good against the motion of the terrestrial crust in historical times.

2. Earth's axis of rotation would wobble: It does.

3. Things would have flown away if unattached: This depends on the time element.

4. Waves of translation and hurricanes would be generated: they were. A section from the first file of my geological work is attached, and explains, partly, the "wilde Raubergeschichte,"[4] in the (second) file you just read.

Argument against a massive comet: The observed comets are of small mass. In answer:

1. Even Jupiter, as all other planets, was once in the category of

comets, according to the planetismal and tidal theories.

2. The origin of the terrestrial planets (Mercury, Venus, Earth, Mars) from the large planets (to explain the difference in the specific weights) is an old legitimate story.

Arguments against the mechanism of disturbance: A gravitational pull by a passing body could not disturb the rotational velocity of the earth or the inclination of its axis. Answer: In Worlds in Collision I brought historical material leaving astronomers to choose:

1. Either the earth was disturbed in rotation,

2. *or* the axis of rotation changed its inclination to the plane of the ecliptic.

Once more, I left for astronomers to choose: The earth was disturbed by entering

1. into a thick cloud of dust,

2. or into a magnet field.

In Worlds in Collision I left open the problem which of these mechanisms was in action (p. 386). You are indignant at the idea that magnetic fields had anything to do with the disturbances. You oppose such explanation

1. because magnetic actions are excluded from the celestial mechanics. Answer: At usual distances. But at close approaches the magnetic fields could be felt.

2. because in a cloud of iron particles there is no reason for all of them to have the same magnetic orientation. Answer: The same question is asked concerning the polarized light of fixed stars that supposedly passes through clouds of gases or dust particles. Also: would the earth, which is a magnet, and possibly has an iron core, moving through a large charged cloud of dust preserve the direction of its axis or not?

The real cause of indignation against my theory of global catastrophes is the implication that celestial bodies may be charged. It was argued that only an astronomer can imagine the degree of coincidence between

the calculations based on the gravitational theory and the observed planetary motions. But this very degree of coincidence is disturbing in the face of many facts known about the sun (behavior of protuberances), the planets (influence of radio-transmission), the comets (self-illuminating; behavior of tails), the fixed stars (strong magnets), the meteorites (magnets). Even for the cases of observed anomalies magnetic or electric charges were not considered, as if they were a tabu in celestial mechanics. Of the many unexplained phenomena presented in my address before the Forum of the Graduate College, you have explained only the apparent spherical form of the sun (and was it correct to disregard the very low atmospheric pressure on the sun in calculating its expected shape?), but not why the sun rotates quicker on the equator, nor many other similar violations of mechanical laws.

Of course, I am a heretic, for I question the neutral state of celestial bodies. There are various tests that could be made. For instance, does Jupiter send radio-noises or not? This can easily be found, if you should wish.

If planets are charged, gravitation is a short range force, a terrible statement to make. Cavendish experiment with varying distances between the attracting bodies would easily disprove such notion. But if I am not wrong, the Cavendish experiment is not performed in a Faraday cage. It should be easy to find out the constant in a cage. But not easy for me. Especially since Shapley in a relentless effort made me “out of bounds” for scientists.

You, too, would not have had any suspicion about my motives in my book on folklore and ancient literature, were it not for the campaign initiated by Shapley. The few pages on astronomy in my book were edited by Lloyd Motz, professor of astronomy at Columbia University. Too early you have thrown the mantle of Jewish compassion over Shapley: you have seen only the beginning of the file of the documents concerning the “Stargazers and Gravediggers” and their leader. His being a liberal is not an excuse but an aggravating cirumstance. My appeal to you to investigate this material was prompted by a new attack, a few days before I last saw you. Then I immersed myself in my work and calmed down.

Cordially,

References

1. “that in fact catastrophes have taken place which must attributed to extraterrestrial causes.”
2. “That these catastrophes can have nothing to do with the planet Venus.”
3. “That also the direction of the inclination of the terrestrial crust towards the ecliptic could not have undergone a considerable change without the total destruction of the entire earth’s crust.”
4. “wild robbers’ story”

September 17, 1954

Dear Professor Einstein:

May I renew our discussion? At our last long conversation on July 21, you have acceded that the cause of the global catastrophes of the past could have been extra-terrestrial.

You have found the behavior of Lexell's comet almost unbelievable.

The next step in my strategy is to show that the comets do not revolve as neutral bodies around a neutral sun. I quote from H. Spencer Jones:

"The presence of bright lines in the spectra [of comets] can only be due to a self-luminous body. . . . the electrical phenomena obtained by discharge through a Gessler's vacuum tube enable the assertion to be made with a high degree of probability that the comet's self-luminosity is due not to an actual combustion, but to an electrical phenomenon."

More facts point to a charged state of the comets. The envelope (coma) of a comet contracts with the approach to the sun and expands with recession, though in the heat of the sun the reverse could be expected.

"There is good evidence that all particles in the comet influence the motion of each other. The configuration of the streamers in the tails . . . strongly indicates a mutual repulsion." (N. Bobrovnikoff, "Comets" in *Astrophysics*, ed. Hynek, 1951, p. 328).

As to the sun: "Certainly the formation of coronals over centers of attraction and sunspots can be caused by the extended electrical fields of these areas of the sun; just so, coronals can be formed by the electrical fields about the end of a moving prominence." (E. Pettit, "The Sun and Solar Radiation," *ibid.*, p. 296).

When prominences on the sun were observed to run one into another, "both prominences participating in the action recoiled violently . . . Strong electrical fields of the same sign might explain the phenomenon." *(Ibid.*, p. 297).

As to the spherical shape of the sun, the measurements were carried to one hundredth part of a second of an arc, and no departure from spherical shape was observed *ibid.*,

p. 260); the admitted error of observation could not exceed a tenth of a second.

Should we now assume that a comet moves in perihelion without experiencing an electromagnetic effect between itself and the sun?

Cordially yours,

Immanuel Velikovsky

January 11, 1955

[sent January 18]

Dear Professor Einstein:

Am I right or wrong in the following: A comet grazing the sun can experience an el.-magn. effect without violating Kepler's 3rd law, because:

1. A static potential difference between the sun and a body on an orbit would also produce an inverse square relation which can be hidden in the gravitational effect.

2. The magnetic component of the effect would produce acceleration. And actually an unaccounted for acceleration is observed in comets passing close to the sun; this effect was studied on Comet Encke. (J. Zenneck, 'Gravitation's in *Encyclop. d. Mathem. Wiss.* vol. V, part I, p. 44).

3. Even assuming a comet as a neutral body partly consisting of ionized gases, and a solar protuberance as a collection of ions of one sign on a neutral sun, we would have in a grazing comet a conductor passing through an electrical field.

By the way, Kepler himself regarded the motion of the planets and comets on ellipses as originating wholly in the sun, and for a time thought of magnetic action (electricity was not yet known; but Gilbert's book on magnetism already appeared in 1600). Kepler wrote:

" [Sol] trahendo et repellendo retinet, retinendo circumducit" *(Opera omnia*, VI, 345).

Actually Kepler's idea of a magnetic field reaching from a primary to a satellite can be checked as follows:

If the lunar daily librations in latitude follow the rotation of the polar magnetic field of the earth around the geographical pole, then the magnetic field of the earth reaches sensitively to the moon. Among lunar daily librations are some unaccounted for. According to H.T. Stetson of M.I.T., a magnetic needle slightly follows the sun.

As to Lexell's comet: It was removed by Jupiter from a parabolic orbit to an ellipse of

5½ (five and a half) year period, and at the next passage it was sent away on a hyperbolic orbit. This I mentioned; you have thought it impossible, even after reading this in Newcomb's astronomy.

You have asked me: what do the specialists say about the shape of the sun. I quote Donald Menzel of Harvard Solar Observatory *(Our Sun,* 1950, p. 39): "but the measures are as likely as not to indicate a *polar* diameter greater than the equatorial, which we are indeed loath to believe."

With all good wishes,

cordially,

Im. Velikovsky

February 2, 1955

Dear Prof. Einstein:

All I wanted in my last letter to you was to gain the concession that a comet, going through the corona of the sun or through an outburst of ionized gases, sustains an electromagnetic effect. The consequences of opening the gate to such an effect into the heavenly mechanics force the astronomer to disregard physical experiences, in order not to violate in the least the system of 1666. But in fact the comets do not follow precisely Kepler's third law: those that pass near the sun (like Encke's comet) show acceleration unexplained by gravitational mechanics.

My knowledge is not great, yet gravitation with static electricity I do not identify, as you understood me and then refuted me with the fall of a body which must discharge itself upon touching the ground. In the following I present my thoughts about the nature of gravitation and discuss also in short—more in the form of questions—the four systems of the world, of which the first is the Newtonian, and the second actually does not violate the Newtonian.

Do you remember how I asked you: If the good Lord would give you the task to conceive a plan for a new universe, where gravitation of the inverse-square variety takes no part, would you be able to comply? To Newton He could not have made such a proposition, since Newton had only a very vague idea of electricity. However, the sentence with which he concludes the "Principia" is very interesting. I let this sentence follow as a supplement.

Enclosure 1

The end paragraph of the PRINCIPIA by Newton

But hitherto I have not been able to discover the cause of those properties of gravity from phenomena, and I frame no hypotheses . . .

And now we might add something concerning a certain subtle spirit which pervades and lies hid in all gross bodies; by the force and action of which spirit the particles of bodies attract one another at near distances, and cohere, if contiguous; and electric bodies operate to greater distances, as well repelling as attracting the neighboring corpuscles; and light is emitted, reflected, refracted, inflected, and heats bodies; and

all sensation is excited, and the members of animal bodies move at the command of the will, namely, by the vibrations of this spirit, mutually propagated along the solid filaments of the nerves, from the outward organs of sense to the brain, and from the brain into the muscles. But these are things that cannot be explained in few words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic spirit operates.

[end of the *Mathematical Priciples*; transl. by F. Cajori]

Plan 1

Newton's plan in which the heavenly bodies in their movements are influenced only by gravitation (and in a very small measure by light pressure). For this plan speak:

a) The simplicity of the law of gravitation. (The simplicity would be more complete if the same system would also be in action as the dominating force in the atom, and if gravitation, like all other energies in nature, were given to transformations).

b) The exactness with which the positions of the planets are predicted. (The exactness of Ptolemaic astronomy in predicting eclipses and conjunctions was superior to that of Copernicus; and still the geocentric system is false).

c) The discovery of Neptune and Pluto (Neptune's position, but not its distance from the Sun was calculated in advance; Pluto's mass is by far not sufficient to explain the disturbances it causes).

Some of the circumstances which cannot be explained, or only with great effort, are:

1. The Sun, Jupiter and Saturn rotate quicker on their equators; the rings of Saturn rotate quicker than the planet. The inner satellite of Mars revolves quicker than Mars rotates; the sun possesses only 2% of the "angular momentum" of the solar system.

2. The Sun's protuberances *gain* in speed with the distance from the Sun. They fall back as if attracted to the place from which they erupted, falling back (as if on a rubber band) to the sun without acceleration.

3. The Sun's equatorial diameter is equal to, and in the consensus of other observers is 0.038 seconds of the arc smaller than the polar diameter (and to this says Menzel: "We are loathe . . .").

4. The tides caused by the Sun in the Earth's atmosphere are 16 to 20 times greater

than those caused by the Moon.

5. The Moon and [some] other satellites always show their planets the same face.

6. The comets' tails are turned away from the sun and move in perihelion with a speed approaching the speed of light; no attempt at quantitative calculation has been made in this direction.

Plan 2

The heavenly bodies are held in their orbits mainly by gravitation; however they are not neutral.

Since static electricity also acts according to the inverse square law, its presence is masked by gravitation. From this follows: The masses of the heavenly bodies are not exactly calculated.

This plan can explain satisfactorily most of the difficulties of Plan 1. For this Plan 2 speak also, among others, the following facts:

1. The Sun too has a general magnetic field the strength of which is estimated very differently—the difficulty lies in the angle of observation. The corona has a form which resembles the lines of force of a magnetic field and extends far out.

2. In several stars a strong magnetic field (7000 gauss) has been detected. These stars must also be electrically charged because electrical currents would hardly occur on hot stars. The movement of two members of a double star system which rotate around each other in a few hours must probably be affected by more than just gravitation alone.

3. The earth is a magnet. The earth is enveloped in electrical layers of the ionosphere. Chapman postulates a strong electrical layer high (12,000 to 16,000 miles) over and around the earth.

4. The planets Mercury, Venus, Mars, Jupiter, Saturn, clearly influence our ionosphere and radio-reception; Jupiter and Saturn also have a connection to the origin of the sunspots.

5. The polar lights consist of electrical charges which come from the sun and which, after eruptions on the sun, or after the passage of a big sunspot, influence radio transmission and ground currents, and cause magnetic storms.

6. Meteorites are magnetized without exception. Also, upon entering the atmosphere they are regularly diverted toward the east and sometimes even seem to be hurled out after they have already penetrated into the atmosphere.

7. The fact that comets glow in cold space (lines of emission), and also the contraction of their heads when closer to the sun, speaks for an electrical effect.

8. A rise and fall in the strength of mutual disturbances between Jupiter and Saturn in the years 1898-99 as opposed to that of the years 1916-17 (18 % difference: J. Zenneck, “Gravitation” in *Encycl. der Math. Wiss.*, vol. V, first part, p. 44), speaks also for this and the following plans.

As to the argument that the photoelectric effect of the sun would neutralize the charges on the planets, I would like to ask: Would not the photoelectric effect cause charges on neutral planets? And why is not our ionosphere neutralized by the photoelectric effect?

The other argument against this plan is in the assumption that the sun cannot be charged because it would repel the surplus ions. I would answer: According to spectral analysis, the atoms on the sun have been left without many, often without any orbiting electrons. Could not the electrons which have left the protons in their closest proximity where the attraction is tremendous, also have left the sun entirely? Actually the sun hurls out charged particles (polar lights, also cosmic rays) as if it were charged and would like to reach a neutral state. (However the sun, charged as it is, changes its charge imperceptibly: were it not so, then the system would constantly change its paths.)

Another reply: In the atom the same problem exists: how can charges of the same sign hold together in the nucleus?

Now a third reply: The stars, which are strong magnets, must also be electrically charged, because no electrical currents can exist at such temperatures. Why do the surplus protons or electrons stay there? And if there, then probably also on the sun.

And finally: Should we not, instead of considering the sun as neutral, rather consider the whole solar system neutral, with a surplus of charge of one sign on the sun and of another sign on the planets?

Plan 3

Gravitation would be a force which quickly diminishes with distance. Static electricity would be the dominating force between the heavenly bodies.

This would mean that the force which we know from our experience on earth as gravitation does not effectively reach the moon.

Against such an explanation speaks the fact that the Cavendish experiment under different conditions and distances between mutually attracting masses always showed the same results. However, as far as I can judge, this experiment was not performed in a Faraday cage; at the same time we know that the atmosphere has an electric potential and that the potential difference strongly increases with distance from the ground, but probably could be almost identical in different laboratories.

This plan of static electricity as the dominating force between the heavenly bodies would explain most of the phenomena which are unexplainable in plans 1 and2, but against it speak the following facts:

1. In the case the planets are all of the same charge (positive or negative), they would repel each other. But would they not behave like two parallel conductors which attract each other when their currents flow in the same direction?

2. If, for instance, the sun is positive and the earth negative, then the moon would again be positive, and the sun would repel the moon.

Plan 4

In this plan, too, gravitation would be a force which diminishes rapidly with distance. Planets, satellites, and comets are charged bodies which move in the magnetic field of the sun, and which themselves create magnetic fields.

This plan would explain:

a. The retrograde movement of various satellites and comets;

b. the distribution of angular momentum;

c. the behavior of cometary tails; also the fact that comets are attracted to the sun from great distances, but were never seen falling into the sun, even though they are unstable in their orbits;

d. the position of the moon and other satellites which continuously turn the same face to their planets;

e. the energy of cosmic rays;

also the fact that the sun is hotter in the corona than in the photosphere; and several other facts.

Since magnetic force decreases quickly with distance, the heavenly bodies must be differently charged in order to obey Kepler's laws. The planets which are further away from the sun must have a correspondingly stronger charge. This would be analogous to the arrangement of electrons in the atom. It would also explain the disturbances caused by Pluto, the mass of which is by far not sufficient to explain such perturbations.

Against this (4) plan speak the enormity of electric and magnetic forces necessary to make this plan effective.

The sun moves in relation to the stars; it rotates; the charged planets revolve around the sun, and create a Rowland magnetic field. How does the magnetic field between the sun and the planets behave, and how quickly does it decrease? (The calculations which I received from several young physicists differ greatly and go all the way from $1/r$ to $1/r^4$).

But above all, are the physical experiences of laboratories always applicable to the sky? There, a very great and hot mass of gases moves in the coldness of space; how would the magnetic field behave under such conditions?

It is apparent that plans 2 and 4 sin less against facts and observations than do plans 1 and 3. In order to decide between plan 2 and 4 the Cavendish measurements between impeccably neutral bodies must be repeated. But how impeccably? The electrical repulsion between two protons is 10^{40} times stronger than their gravitational attraction.

With cordial greetings,

Yours

Immanuel Velikovsky

March 7, 1955

Dear Professor Einstein:

I thank you again for the discussion of the first 8 pages of my letter. Here are the quotations from John Herschel and W. Pickering I have mentioned in our last conversation:

"There is beyond any question some profound secret and mystery of nature concerned in the phenomenon of their tails"; "enormous sweep which it [the tail] makes round the sun in perihelion, in the manner of a straight and rigid rod, is in defiance of the law of gravitation, nay, even of the recorded laws of motion."

J. Herschel, *Outlines of Astronomy*, p. 406

"What has puzzled astronomers since the time of Newton, is the fact that while all other bodies in the sidereal universe, as far as we are aware, obey the law of gravitation, comets' tails are clearly subject to some strong repulsive force, which drives the matter composing them away from the sun with enormously high velocities."

— W.H. Pickering, article "Comets" in *Encyclopedia Americana.*

Cordially yours,

Immanuel Velikovsky

17.III.55

Lieber Herr und liebe Frau Velikowsky!

Sie haben mich bei Gelegenheit dieses unseligen Geburtstags aufs neue beschenkt mit Fruchten einer geradezu eruptiven Produktivitat. Ich freue mich auf die Lekture des historischen Werkes, das ja die Hühneraugen meiner Gilde nicht in Gefahr bringt. Wie es mit den Hühneraugen der andern Fakultät steht, weiss ich noch nicht. Ich denke an das rührende Gebet: Heiliger St. Florian, verschon's mein Haus, zünd'ändere an!

Den ersten Band der Memoiren zu "Worlds in Collision" habe ich bereits aufmerksam gelesen und mit einigen leicht zu radeirenden Randbemerkungen versehen. Ich bewundere Ihr dramatisches Talent und auch die Kunst und Geradheit von Thakeray, der brüllenden astronomischen Löwen dazu gebracht hat, eingermassen den königlichen Schwanz einzuziehen unter nicht völliger Respektierung der Wahrheit. Ich würde glücklich sein, wenn auch Sie die ganze Episode von der drolligen Seite geniessen konnten.

Unvorstellbare Korrespondenz-Schulden und ungelesene zugesändte Manuskripte zwingen mich zu Kurze. Vielen Dank Euch beiden und Freundliche wünche.

Ihr

A. Einstein

Translation:

17.III.55

Dear Mr. and dear Mrs Velikovsky!

At the occasion of this unpropitious birthday you have presented me once more with the fruits of an almost eruptive productivity. I look forward with pleasure to reading the historical book that does not bring into danger the toes of my guild. How it stands with the toes of the other faculty, I do not know as yet. I think of the touching prayer: "Holy St. Florian, spare my house, put fire to others!"

I have already carefully read the first volume of the memoirs to “Worlds in Collision,” and have supplied it with a few marginal notes in pencil that can be easily erased. I admire your dramatic talent and also the art and strightforwardness of Thackrey who has compelled the roaring astronomical lion to pull in a little his royal tail without showing enough respect for the truth. I would be happy if you, too, could enjoy the whole episode from its funny side.

Unimaginable letter debts and unread manuscripts that were sent in force me to be brief. Thanks to both of you and friendly wishes,

Your,

A. Einstein